Meridian 1

Meridian data features

Traffic engineering and configuration

Document Number: 553-2731-151
Document Release: Standard 6.00
Date: April 2000

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Revision history

April 2000

Standard 6.00. This is a global document and is up-issued for X11 Release 25.0x.

December 1994

Standard, release 5.00. Reissued to include editorial changes and indexing. Due to the extent of the changes, revision bars are not used.

December 1992

Standard, release 4.00. This document was reissued to include technical content updates. Due the extent of the changes, revision bars were not used.

August 1990

Standard, release 1.00. Reissued for compliance with Nortel Networks standard 164.0.

Release 2.00 omitted.

Release 3.00 omitted.

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Introduction

Content list

The following are the topics in this section:

- Reference list 7
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- Related documents 9

Reference list

The following are the references in this section:

- *System Engineering* (553-3001-151)
- *Meridian Data Features: Operations and Tests* (553-2731-300)
- *NT7D16 Data Access Card: Description and Operation* (553-3001-191)
- *X11 Administration* (553-3001-311)

This document provides configuration guidelines for implementing Meridian data features in Meridian 1 systems. Use the traffic and service tables in this document to determine your system requirements.

Service facilities allocated when engineering Meridian data features include the following: Data Line Cards (DLC) or Asynchronous Interface Line Cards (AILC) and station line circuit packs, trunk circuit packs, Add-on Data Modules (ADM), or Asynchronous Interface Modules (AIM) or Multi Channel Data Systems–Asynchronous Card (MCDS–AC) ports, and computer ports modem pool equipment. The AILC is only used with the AIM. This publication gives recommendations for the distribution of these facilities in various application types.

References to ADMs imply all data modules or MCDS-AC ports unless stated otherwise.

You can use the publication *System Engineering* (553-3001-151) to determine other equipment calculations, such as those for provisioning tone and digit switches, DIGITONE receivers, conference circuit packs, and overall shelf and cabinet requirements.

Description

The Meridian data features integrate dial-up data switching capabilities with voice calling capabilities from telephone sets, and they extend to data users several Meridian 1 system and station calling features.

When implementing the Meridian data features, be aware of the two types of traffic using your system: voice traffic and data traffic.

- Voice traffic characteristics typically reflect homogeneous patterns because this type of traffic is generated for a single application: conversations between people. When actual holding times for voice calls are not known, assume certain average holding times per call (for example, 2 to 5 min) when engineering your Meridian 1 system.
- Data traffic, however, can be produced by many kinds of data processing applications. This variety results in heterogeneous traffic patterns where holding times for data calls differ widely, dependent upon the specific data application. For example, data-call holding times can range from several minutes in a simple inquiry-response application to several hours in a remote job-entry application. Because of this wide range of call patterns, use of an average holding time for data calls (often considered to be about 20 to 30 min) can result in under- or over-engineering in actual applications.

While the anticipated calling rate must also be considered when engineering for voice and data traffic, the call holding time distribution is the more important consideration in engineering the Meridian data features. In general, as the call holding time increases, the calling rate decreases.

Related documents

For complete descriptions of the Meridian data features, refer to these documents:

— *Meridian Data Features: Operations and Tests* (553-2731-300)

— *NT7D16 Data Access Card: Description and Operation* (553-3001-191)

— *X11 Administration* (553-3001-311)

System grade of service

Content list

The following are the topics in this section:

- Reference list 11
- Timeslot blockage 12
- Service facility unavailability 12

Reference list

The following are the references in this section:

- *System Engineering* (553-3001-151)
- "Configuration guidelines" on page 25

Basic definitions of traffic distribution and grade of service (GOS) appear in *System Engineering* (553-3001-151). When configuring your Meridian 1 system to include the Meridian data features, consider GOS desired for both data traffic and voice traffic.

The following two factors affect the system grade:

- **Timeslot blockage**, which is the probability of blocking due to the unavailability of timeslots in the Meridian 1.
- **Service facility unavailability**, which is the probability of blocking due to the unavailability of a called service facility.

Timeslot blockage

Since timeslot blockage is a function of the amount of traffic connected on the network loop (both voice and data traffic) at the time the call is made, the probability of timeslot blockage is the same for both voice calls and data calls.

The Meridian 1 system cannot be engineered to give a different GOS for voice traffic and another GOS for data traffic with respect to timeslot blockage, unless voice traffic and data traffic are segregated on separate network loops.

The GOS desired for data traffic and the GOS desired for voice traffic in the Meridian 1 should be engineered to meet the more stringent GOS requirement of the two. Since the GOS to which data users are traditionally accustomed often falls well below the P.01 and P.02 level of blockage typically engineered for voice traffic, the voice traffic GOS is likely to be the more stringent.

The selected GOS determines the maximum average CCS to be handled per network loop in your system. Both voice and data CCS contributions are included in this figure. See Table 3 for the allowable CCS per network loop for different grades of service.

Service facility unavailability

Blockage due to the unavailability of a called service facility is a traffic factor reflected by the number of service facilities in your system. While this factor is not used in determining traffic handling capacity, consider the network termination constraints applicable to the Meridian 1 when calculating service facility requirement and when balancing anticipated traffic loads for both voice and data traffic among the network loops.

Refer to the service facility use tables in this document to determine the recommended number of service facilities for different grades of service.

Refer to "Configuration guidelines" on page 25 to determine your system requirements and limits when provisioning for the Meridian data features.

Data call characteristics

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- Calls to a computer port 14
- Calls to an outgoing trunk 15
- Calls from an incoming trunk 17
- Calls to an MCDS 18

Reference list

The following are the references in this section:

- *Meridian Data Features: Operations and Tests* (553-2731-300)

The types of data calls possible with the Meridian data features fall into these categories:

- Calls to a data communications terminal
- Calls to a computer port
- Calls to an outgoing trunk (via outbound modem pool)
- Calls from an incoming trunk (to an inbound modem pool)
- Calls to a Multi-Channel Data System (MCDS) channel

Calls to a data communications terminal

This type of data call is similar to an intra-office voice call because it is a call to a specific line termination within your Meridian 1 system. Two timeslots are used to establish these calls, and the grade of service (GOS) is the same as that of the overall system. Calls through the MCDS are the same as through an Add-on Data Module (ADM).

Calls to a computer port

This type of data call is similar to an outgoing voice call to a hunt group because it can be connected to any one of several common line terminations. This call may use an ADM or one port of an MCDS.

> ***Note:*** If only one computer port is provided, then this call-type is like a call to a data communications terminal.

Two timeslots are used for calls to a computer port, and the GOS with respect to timeslot blocking is the same as the overall system grade of service. Blockage may still occur, assuming an adequate GOS, if the number of computer ports is insufficient.

If timeslot blockage occurs when a data call is placed to the computer port, the system does not attempt a second call to locate timeslots for another port on a different network loop.

Calls to an outgoing trunk

A data call can be made through your Meridian 1 system to a remote computer over an outgoing analog trunk. Outgoing trunks are accessed for data calls from within your system via a modem pool arrangement; this data-calling capability is unique to the Meridian data features and involves five separate terminations:

- The originating station (ADM and the Asynchronous Interface Module (AIM) data side)
- The originating station (voice side)
- The modem pool (inbound side with ADM)
- The modem pool (outbound side with modem)
- The outgoing trunk (to remote computer)

Setup for a data call made via an outgoing trunk momentarily (just during transfer stage) requires three separate Meridian 1 paths (6 timeslots) to establish the connection. The sequence is as follows:

Connection l: a to c user initiated

Connection 2: b to e user initiated

Connection 3: d to e

Note: Connections 1 and 2 can be performed in reverse order, but the above sequence is recommended.

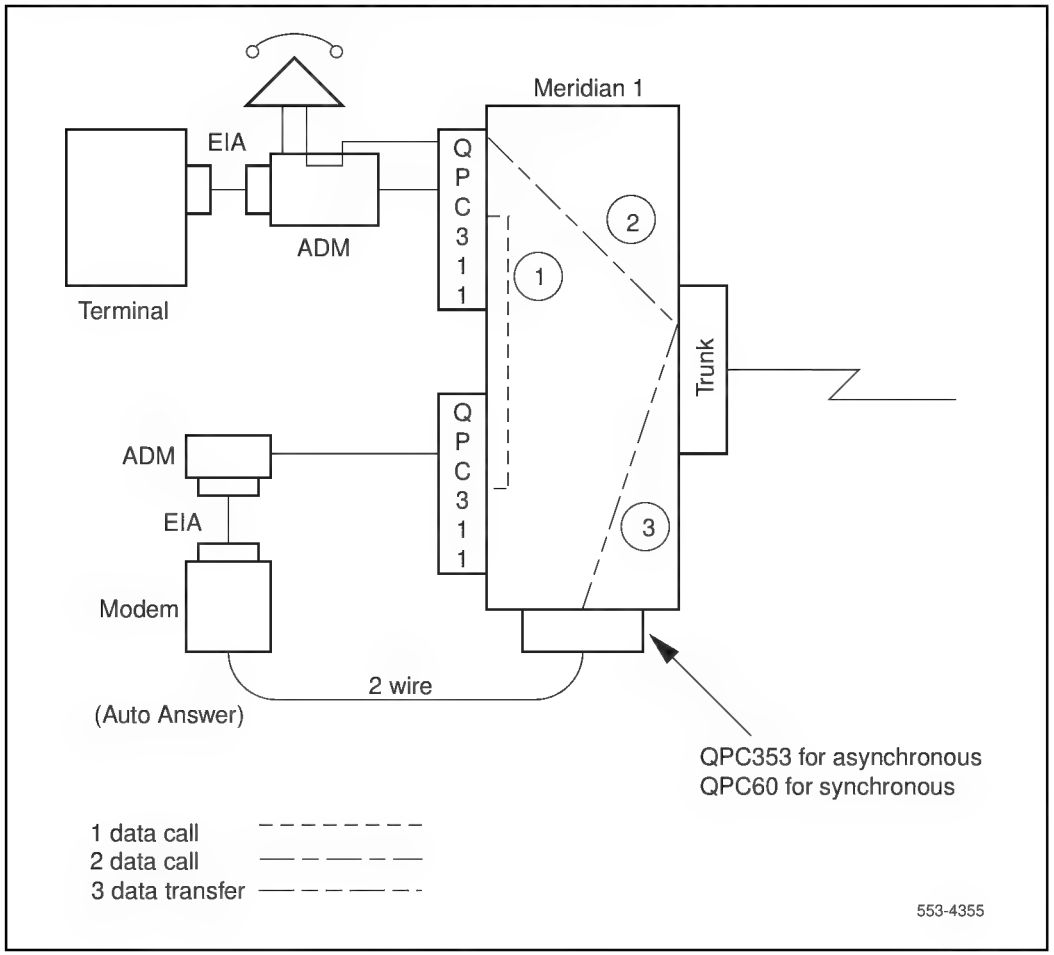
Only Connection 1 and 2 are user initiated. When Connection 2 is established, user-control intervention allows the system to Call Transfer this connection to become Connection 3.

Note: With Automatic Modem Pooling (AMP) the three-step process of accessing the modems is replaced with a one-step procedure. The insertion of the ADM/Modem by the Meridian 1 switch is totally transparent to the user.

After call setup is complete, two paths (four timeslots) are in use during this data call to a remote computer: Connection 1 and Connection 3. Thus, once established, this type of call constitutes one intra-office data call, plus one outgoing-originating voice (outgoing trunk) call in terms of traffic generated.

Figure 1 illustrates the call-setup sequence for data calls made to a remote computer via modem pool. For a detailed operating description of this type of call setup, refer to *Meridian Data Features: Operations and Tests* (553-2731-300).

Figure 1
Call setup to outgoing trunk (via modem pool without AMP)



Calls from an incoming trunk

A data call can be made through your Meridian 1 system to a computer port or terminal over an incoming analog trunk only. The computer port or terminal is accessed from within your system via a modem pool arrangement; this data-calling capability is unique to the Meridian data features. This capability involves four separate terminations:

- The incoming trunk (from remote user)
- The modem pool (inbound side with modem)
- The modem pool (outbound side with ADM)
- The terminating station (ADM-data side)

Setup for a data call made from an incoming trunk requires two separate Meridian 1 paths (four timeslots) to establish the connection. The sequence is as follows:

Connection 1: a to b user initiated

Connection 2: c to d Meridian 1 initiated for Hot Line; user initiated with keyboard dialing

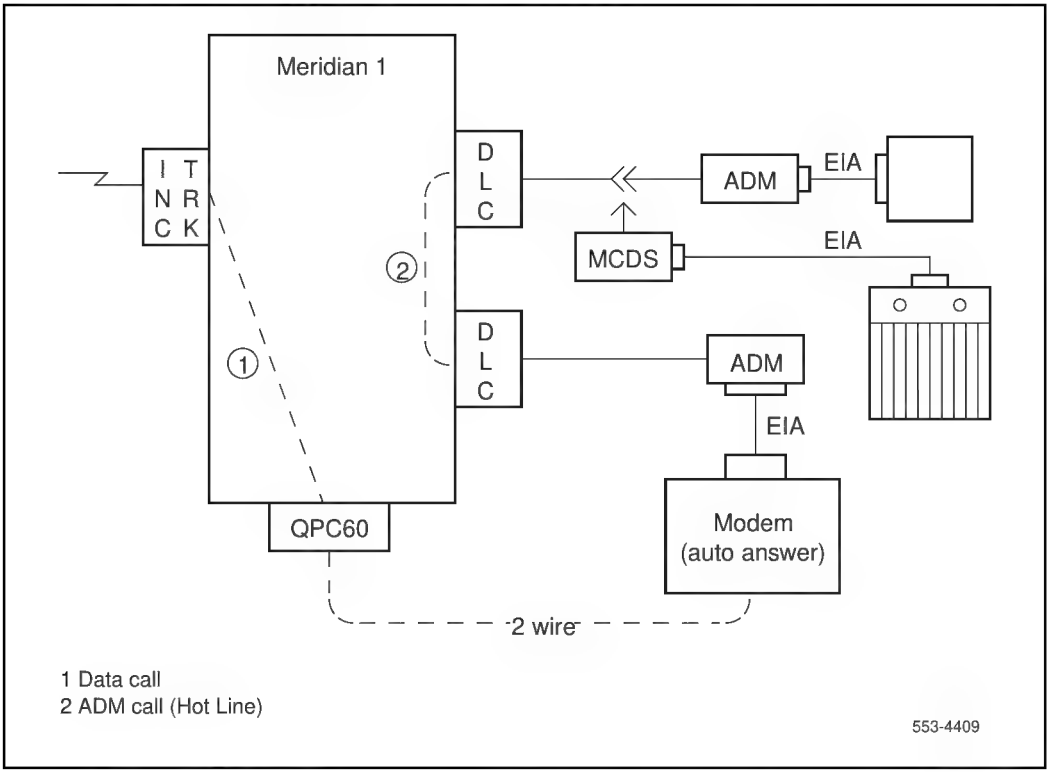
One or both of these call-setup connections are user initiated. When Connection 2 is established, user-control intervention then allows data to be transmitted.

Note: With AMP, the incoming call can terminate on a customer data port or a data set. The data set has a special class of service while the data port is a member of an ADM trunk route. If the incoming call is analog (not digital) and the data port is not analog, then an ADM/Modem pair is switched into the connection for data transmission. The data ports are organized into trunk routes. When the proper number is dialed for a data port or a data set, the system selects the proper modem from the pool and inserts it into the connection.

After call setup is complete, two paths (four timeslots) are in use during this data call from a remote user. Once established, this type of call constitutes one intra-office data call plus one incoming-originating voice (incoming trunk) call in terms of traffic generated.

Figure 2 illustrates the call-setup sequence for data calls made from a remote user to a computer port or terminal via the modem pool on your Meridian 1 system.

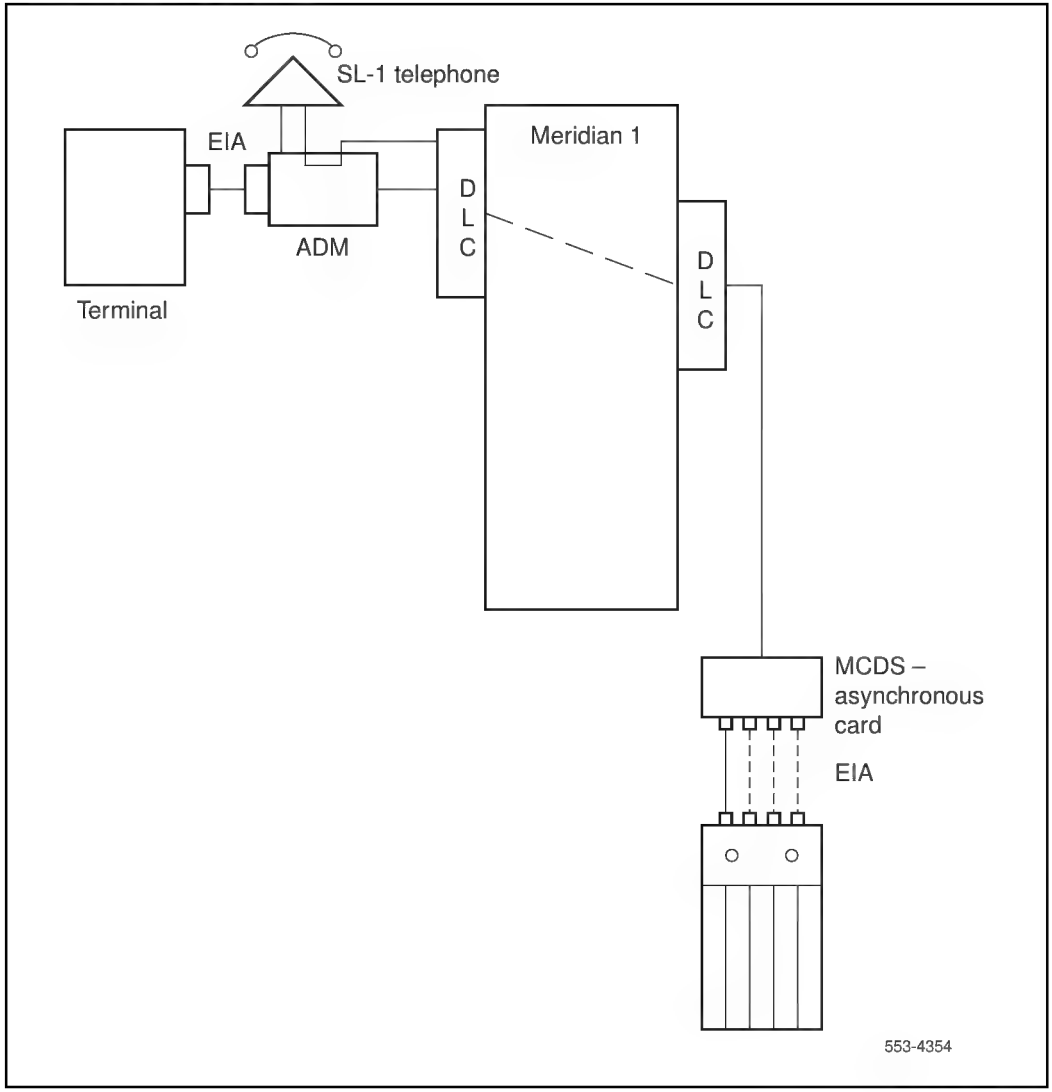
Figure 2
Call setup from incoming trunk (via modem pool)



Calls to an MCDS

This type of data call illustrated in Figure 3 is similar to an intra-office voice call because it is to a specific line termination within your system. Two timeslots are used to establish these calls, and the GOS is the same as that of the overall system.

Figure 3
Call setup to MCDS port



Data calling traffic impact

Content list

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- Outbound Modem Pool calls 21
- Inbound Modem Pool calls 22
- Ring Again queuing 22
- Keyboard dialing 23

Implementing the Meridian data features provides data users with access to several system features and station calling features. These include Automatic Route Selection, Hunting, Remote Peripheral Equipment, and Call Detail Recording on the system level. Autodial, Call Forward, Ring Again, and Speed Call are assignable to each co-located or stand-alone ADM or AIM. Keyboard dialing may be assigned to all co-located and stand-alone ADMs (except QMT7) and to AIM. Either the Hot Line or the Autodialing feature may be assigned to those data stations (except QMT9) that use keyboard dialing. Modem Pool services require a stand-alone ADM with a modem and the implementation of Meridian data services (QMT9 are not used for modem pools). Only two of these features associated with Meridian data—Ring Again queuing and Modem Pooling—and have a particular impact on data traffic engineering.

Outbound Modem Pool calls

Blockage for a Modem Pool call is higher than that of the GOS for the overall system because of the need to establish three separate Meridian 1 call paths during the setup of a data call to remote computer via modem pool.

Assuming these three path setups were independent of one another, the blockage would be approximately three times greater than that of the GOS for the overall system. Because, however, all three paths must be complete to establish an active outbound call through the modem pool, these paths are interdependent. Therefore, assuming call-path dependence and a system GOS of P.01, the Modem Pool call would experience an average blockage of 4.5 percent.

Additionally, since the established data call through the modem pool consists of one intra-office data call and one outgoing-originating voice call, Modem Pool calls generate twice the network CCS of a regular voice call or intra-office data call.

Inbound Modem Pool calls

Blockage and system grade of service is the same here as for the outbound modem pool except that only two separate paths are setup for the data call from the incoming trunk via the modem pool.

Ring Again queuing

Ring Again feature operation is the same for data calls as it is for voice calls: it allows queuing of calls made to busy Directory Numbers (DN) within the customer group, alerts the user when the busy DN becomes free, and provides automatic call back to the DN.

For calls placed from a Data Directory Number (DDN), use Ring Again when you encounter calls to a busy data terminal, computer port, trunk route, (for example, WATS), or a modem pool DDN.

> ***Note:*** For both voice and data calls, Ring Again does not apply to busy facilities encountered outside of the customer group.

The queuing capability Ring Again provides typically increases the use of all called service facilities within the SL-1 system. Therefore, the probability of delay (rather than blockage) and a measure of average queuing time become significant criteria in specifying the GOS for the overall system.

Since Ring Again queuing increases service facility use, thereby increasing the traffic these facilities carry, the CCS load per network loop will also increase unless the number of terminations per loop is decreased. For example, if 10 computer ports assigned to a network loop are operating at 44 percent of use without Ring Again queuing, the traffic generated is 159 CCS (36 .44 10). Assuming an increase of use to 86 percent with Ring Again queuing, the traffic generated would then be 310 CCS (36 .86 10), which is 151 CCS more than the original traffic calculation made without compensation for queuing. If this additional 151 CCS generated via queuing were to cause the total network loop CCS to exceed the limit for the desired GOS, then reassignment of line terminations to other network loops would be made as necessary.

Keyboard dialing

Keyboard dialing provides the capability to originate and terminate data calls to local computers by using the terminal keyboard. It is used by all co-located and stand-alone ADM (except QMT7) and by the AIM to activate the data feature. The Hot Line or Autodialing feature may be used with keyboard dialing to originate data calls. The Data Directory Number (DDN) Ring Again can be used when you encounter calls to a busy data terminal, computer port, trunk route, or modem pool DDN.

> ***Note:*** For both voice and data calls, Ring Again does not apply to busy facilities encountered outside of the customer group.

Configuration guidelines

Content list

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- Assignment procedures 26
- Operating parameters 27
- Memory requirements 27
- Real-time requirements 28
- Network traffic requirement 29
- Termination requirement 31
- Configuration parameters 31
- Modem pool and computer port allocation 32
- Modem pool calculations 33

Reference list

The following are the references in this section:

- *System Engineering* (553-3001-151)

Assignment procedures

When assigning actual data terminations to specific network loops, place each end of a potential call path on separate loops. You can do this by placing computer ports on separate loops from outgoing trunks and placing terminals and inbound modem pool terminations on different loops. Inbound and outbound modem pool terminations can be on the same loop since no timeslot path exists between them. These guidelines are independent of the size of the Meridian 1. On multiple network group systems (VL, VLE, XL), you should still try to minimize junctor traffic between groups. You can do this by placing all data traffic in the same network group.

> ***Note:*** Engineer the routing of data calls carefully because certain modules (that is, AIM) do not give warning tones and any alternate routing signals Network Alternate Route Selection/Basic Alternate Route Selection (NARS/BARS) are not available to warn the user that the module is connected through on an expensive route.

Assignment of peripheral equipment and common equipment for the overall system in which the Meridian data features is implemented should be done according to the procedures given in *System Engineering* (553-3001-151).

When assigning equipment indigenous to data, carefully consider the impact this feature places on the overall system capacity and on equipment planning.

Operating parameters

The Meridian data features can be implemented in any Meridian 1 system. The capacity of each Meridian 1 is subject to five independent constraints. To include data, compensate for these constraints, which are listed as follows:

- Memory capacity
- Real-time capacity
- Network traffic capacity
- Network terminating capacity
- Configuration limits

Any of the above factors can limit system size gives the actual system capacities and limits for each Meridian 1 *System Engineering* (553-3001-151).

Memory requirements

The Meridian data features has no effect on the storage requirements of the system software program. When assigning each ADM or MCDS-AC or AIM and its data calling features, however, the protected and unprotected data storage requirements are the equivalent of those for a telephone and its assignable features. See *System Engineering* (553-3001-151).

Real-time requirements

The maximum real time available in each Meridian 1 is 2100 seconds. Depending upon the calling applications, data traffic characteristics can produce a wide range of real-time requirements. That is, a data call from an inquiry-based system could have a short holding time and high call attempts, thus using more real time than an interactive computer application where holding time is long and call attempts are low.

Real-time use by the Meridian data features is dependent upon the types of data calling applications accommodated as well as the number of all data call attempts made. Do the following to assess whether sufficient real time will be available for a particular data application:

- Estimate the number of average busy season busy hour (ABSBH) data call attempts (including blocked, busy, and unanswered calls) for each type of data call (that is, calls to terminals, computer ports, and outgoing trunks).
- Multiply the number of each type of data call by the real time for each type.

  Note: A data call attempt produces the real-time equivalent of a voice call attempt. See *System Engineering* (553-3001-151).

  — Call to a data terminal = 1 intra-office call

  — Call to a computer port = 1 intra-office call

  — Call to a remote computer = 2 intra-office calls + 1 trunk call (Outgoing Modem Pool call)

  — Call from an Incoming Trunk to a modem pool = 1 trunk + 1 intra-office call (Incoming Modem Pool call)
- Take the total data real time calculated from the previous item and add this sum to the total real time required for voice call processing (as calculated from *System Engineering* (553-3001-151).
- The total real time required for successful calls (both voice and data) should be less than 2100 seconds.

Note 1: No features are included in the above measurements.

Note 2: Measurements for an ADM and an SL-1 telephone are equivalent; calls to a trunk (Outgoing Modem Pool call) are made from the Prime Directory Number (PDN) of the ADM's companion SL-1 telephone, and the above measurements apply.

Note 3: Three individual calls constitute a complete Outgoing Modem Pool call setup. The above measurements reflect real time required for each call. Therefore, the sum of 2 intra-office calls + 1 trunk call = 1 complete Modem Pool call real-time measurement.

Note 4: Two individual calls constitute a complete Incoming Modem Pool call setup. The above measurements reflect real time required for each.

Network traffic requirement

Each network loop is capable of the maximum traffic capacities given in Table 3. With the inclusion of the Meridian data features, consider the data line usage in the calculations required to determine the total network traffic requirements.

Consider data calls to terminals or computer ports as intra-office calls. Modem Pool calls, once established, constitute one intra-office call plus one outgoing-originating trunk call. Total data usage is the product of the average number of calls multiplied by the average holding time.

Performing the following calculations yields the total data usage figure:

TOTAL DATA USAGE = (A + B) X 2

where A = the number of data calls to terminals, computer ports, or both, times the estimated holding time and B = the number of Modem Pool calls times 2 times the estimated holding time.

Note: Convert the results of the above calculations to CCS in the following ways:

- If the total data usage is expressed in minutes, multiply by 60 and divide by 100.
- If the total data usage is expressed in hours, multiply by 36.

Two basic traffic definitions stated in *System Engineering* (553-3001-151) now include data traffic contributions as follows:

- Line CCS = Incoming Terminating CCS (voice)
  - — Outgoing Originating CCS (voice)
  - — Terminating Intra-office CCS (voice)
  - — Originating Intra-office CCS (voice)
  - — Originating ADM CCS (data)
  - — Terminating ADM CCS (data)
  - — Outgoing Modem Pool Call CCS (data)
- Intra-office Ratio (R) = Terminating Intra-office CCS (voice)
  - — Originating Intra-office CCS (voice)
  - — Originating ADM CCS (data)
  - — Terminating ADM CCS (data)
  - — Line CCS

In these modified traffic definitions, total line CCS consists of all voice line calls plus all ADM CCS and actual trunk CCS associated with a Modem Pool call. Therefore Total Loop CCS = Total Line CCS x (2 – R).

Using the traffic definitions stated above when Meridian 1 data is implemented, you can determine the network CCS and the required network equipment for the system using *System Engineering* (553-3001-151).

Termination requirement

Each peripheral equipment (PE) shelf accommodates 10 line or trunk circuit packs, or both, and each network loop interfaces with a maximum of four PE shelves. (The number of Digitone receivers supplied is not included in this figure.)

The Data Line Card (DLC) used with the Meridian data features supports two data lines and two voice lines. A maximum of four DLCs can be installed in each PE shelf. This allows a maximum of 32 data lines per network loop (four PE shelves).

Each voice-line circuit pack (QPC60, QPC61, and QPC353) supports 4 voice lines, and a total of 160 lines (4 lines x 10 cards x 4 PE shelves) can be installed per network loop. When 4 DLCs are installed per network loop, the voice-line terminating capacity becomes 128 (4 lines x 6 cards) + (2 lines x 4 cards) x (4 PE shelves) per network loop. Of this total voice-line terminating capacity of 128, one line unit of a Modem Pool Line Card (MPLC) is required to provide a Voice Frequency Directory Number (VFDN) for each modem associated with a modem pool ADM. (**The MPLC and the VFDN are not used if the AMP feature is active**.) Since the MPLC supports only pooled modems, the total loop terminating capacity for voice lines used for voice traffic becomes 128–4n (where n = the number of MPLCs). The trunk terminating capacity per network loop is 80 (2 trunks per trunk card x 10 cards x 4 PE shelves). There can be an arbitrary mixture of lines and trunks per loop, but the number of data lines can never exceed eight (4 DLC) per shelf.

Configuration parameters

The configuration of a Meridian 1 system that has Meridian data features is flexible within the constraints specified in the *System Engineering* (553-3001-151). A system may not be able to accommodate all of the maximum values given in that table because of system limitations on the real time, total memory, or network traffic capacity.

Modem pool and computer port allocation

Through use of the ADM, voice-grade modems and computer ports can be allocated on a contention basis; that is, dedicated connections from terminals to voice-grade modems, computer ports, or both, can be eliminated as customers' data applications permit.

In general terms, the following procedures provide contention for computer ports:

- Connecting a stand-alone ADM to each computer port
- Assigning the Data Directory Number of each ADM connected to a computer port to a single hunt group

  Note: When the AMP feature is used, there is no need for separate modem pools. With the Data Port Hunting feature, the DDN of each Data Port is assigned as a trunk and is hunted as a trunk group.

Contention for voice-grade modems is accomplished by configuring a modem pool.

Outbound modem pool

In general terms, configure a modem pool through the following procedure:

- Connect each voice-grade modem to a stand-alone ADM on the inbound (digital) side.
- Connect the outbound (analog) side of each of these modems to a unit on a MPLC.
- Assign the DDN of each ADM connected to these modems to a single hunt group.

Inbound modem pool

In general terms, configure a modem pool through the following procedure:

- Connect each voice-grade modem to a stand-alone ADM on the outbound (digital) side.
- Connecting the inbound (analog) side of each of these modems to a unit on a 500-set line card.
- Assign the DDN of each line card connected to these modems to a single hunt group.

Modem pool calculations

Determine the number of pooled modems and computer ports according to a grade of service (GOS) selected by the customer. (This GOS applies to the availability of these service facilities, not to the GOS of the overall system.)

If no Ring Again queuing is desired, the service facility GOS is a specified blockage level. When no queuing is provided, the length of the call does not affect the blockage level.

If the Ring Again queuing is desired, then the service facility GOS is specified as an average queuing time (that is, delay time). When queuing is provided, the length of the call does affect the GOS. As the average call length increases, the amount of traffic that can be carried decreases for the same GOS.

To determine the required number of computer ports or modems in each modem pool, use the following procedure:

1. Estimate the number of successful calls to the service facility per hour (that is, the average busy season busy hour).
2. Multiply the average holding time (in CCS) per data call by the total calls calculated in Step 1. The product equals the total traffic offered to the service facility.
3. Using the total traffic offered and the desired GOS, determine the required number of modems or computer ports by referring to Tables 4 through 25.

   Note: When more than one modem pool is to be provided and each pool supports different services (for example, differing transmission speeds), this procedure should be used to size each modem pool.

Traffic and service facility tables

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- Traffic table format 37
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Definitions

Four sets of traffic tables are included in this publication. Each table specifies whether queuing (that is, Ring Again) is to be used and the effective size of the calling population generating the traffic. Table 1 presents the table numbers that correspond to these respective characteristics.

Table 1
Traffic table cross-reference

	Size of call population	
	Infinite	**Finite**
No Queuing	Table 4	Tables 6 through 15
With Queuing	Table 5	Tables 16 through 25

Queuing

To activate queuing on the Meridian 1, use the Ring Again feature. The queuing time is the time from which Ring Again is initiated until a service facility or station becomes available. Because more traffic can be carried when queuing is used, fewer service facilities are required for the same level of traffic.

Calling population

The size of the calling population is important because the size affects the rate at which traffic is generated. The calling population consists of the telephones, terminals, or both, to be considered.

Infinite population

The term "infinite" is used to imply a large number. A population is considered infinite when the overall calling rate is not affected when one member of the population goes into service; that is, each individual telephone or terminal has little impact on the overall system. Almost all voice systems are assumed to have "infinite" populations.

Finite population

A "finite" population is defined as one where the calling rate is affected when a member goes into service. Because each member of the population is such a large percentage of the total, the calling rate decreases when a member goes into service since there is respect to the "finite" tables, the number in source is the number of telephones or terminals being considered. The number in the source in the tables goes up to 50. For numbers above 50, the results from finite population assumptions begin to converge with the results from the infinite population assumptions.

Population size tables

As a general rule, the "infinite" tables should be used for population sizes of more than 50 and "finite" tables for population sizes of 50 and below. More traffic is carried when the population is "finite." Therefore, fewer service facilities are required from the same level of traffic.

Traffic table format

Traffic Tables 4 through 25 follow the same basic format. The table title identifies which of the two characteristics (that is, queuing or no queuing and infinite or finite) apply to that table. Finite source Tables 6 through 25 are explicitly labeled as such. The finite source tables also have the number in the source printed in the table heading. The infinite source Tables 4 and 5 are not explicitly labeled.

These traffic tables present the maximum CCS load that can be offered to a specified number of service facilities (such as trunk, ports, or modem pools) and still meet a specified grade of service. Of the seven columns per table, the left-hand column gives the number of service facilities. The remaining six columns present CCS values for six different grades of service. For no queuing, the GOS is blocking probability and the column heading is "0.XXX," where XXX is the blockage value. For queuing, the GOS is a ratio of the average queuing time (or delay) divided by the average holding time per call. The column heading is "X.XX," where D/HT is delay divided by holding time and X.XX is the ratio. To determine, for example, the maximum CCS that could be offered when each call averages 10 minutes with a delay of 5 minutes, refer to the column labeled "0.50."

> ***Note:*** The queuing delays are averaged over all calls and not just for the calls which are delayed.

Values for traffic offered are presented in the traffic tables. With queuing, the traffic carried equals the traffic offered. With no queuing, the traffic carried equals the traffic offered multiplied by (1 – GOS). For example, at P.02, if 100 CCS of traffic is offered, then 100 x (1 – .02) = 100 x .98 = 98, and 98 CCS of traffic is carried.

As stated earlier, queuing permits circuits to carry more traffic than when no queuing is allowed. Also, as the average call holding time increases (that is, the D/HT decreases), the amount of traffic decreases. Tables 4 through 25 were produced using the generally accepted formulas in the telephone industry. Table 2 below shows the formulas used.

Table 2
Traffic table formulas

	Size of population	
	Infinite	**Finite**
No queuing	ERLANG B (blocked calls cleared) Table 4	ENGSET (blocked calls cleared) Tables 6 through 15
With queuing	ERLANG C (blocked calls delayed) Table 5	ENGSET (blocked calls delayed)

Examples of use

Tables 4 through 25 can be used in the following ways:

- To determine how much traffic can be offered to a specified number of service facilities at a specified GOS, go down the left-hand column to the number of service facilities and read the value out of the appropriate GOS column.
- For grades of service not listed, interpolate between adjacent columns.
- To determine the number of service facilities required to handle a specified amount of traffic, first convert the traffic figure into the offered CCS, and then go down the appropriate GOS column until the first value that equals or exceeds that traffic value is located. Then read the required number of service facilities from the left-most column on the same line.

The following five sample cases illustrate various ways the traffic tables can be used.

CASE 1

Assume
25 time-sharing terminals

20 minutes average holding time per call

5 calls per day per terminal evenly spread over an 8 hour day

Problem
Determine the required number of computer ports if there is

1 No queuing and a P.05 GOS

2 Queuing and an average delay of 10 minutes

3 Queuing and an average delay of 5 minutes

Solution
Total hours of usage = (25 terminals) (1/3 hr per call) (5 calls) = 41.67 hr

Hourly CCS = (41.67 hr) (36 CCS per hr)/(8 hr) = 187.5 CCS or 188 CCS

With only 20 terminals, the finite source tables should be used.

1 Using Table 10, 188 CCS at P.05 requires 9 ports

2 D/HT = 10 min / 20 min = 0.5

3 Using Table 20, 188 CCS with D/HT = 0.5 requires 6 ports

4 D/HT = 5 min / 20 min = 0.25

5 Using Table 20, 188 CCS with D/HT = 0.25 requires 7 ports

CASE 2

Assume
An inquiry application with a large number of terminals currently uses dial-up modem to gain access to the computer. Sixty-four ports are now allocated to this function, and the blockage is thought to be about 5.

Problem
Determine the percentage of traffic increase realized if Ring Again is used to queue for the ports? Assume a D/HT ratio of 1.

Solution
Because there are a large number of terminals, the infinite source tables should be used.

From Table 4, 64 ports at P.05 can carry: (2109.6 CCS) (.95) = 2004 CCS.

From Table 5, 64 ports at a D/HT ratio of 1 can carry 2272.6 CCS.

Therefore, the percentage increase is

2272.6 – 2004 / 2004 x 100 = 13.4%

Note: The Meridian data feature can be justified by showing an increased use of computer resources via Ring Again.

CASE 3

Assume

A company uses 10 computer terminals to access a computer at the plant as well as a computer at a distant location. About 10 percent of the time, the distant computer is used.

Each terminal is used approximately 45 minutes per hour. Each terminal is connected about 30 minutes per session.

Problem

Determine the number of ADMs required for this application if a 15-minute delay is acceptable.

Solution

Total hourly usage = (10 terminals) (3/4 hours) = 7.5 hr

Remote usage = (10.) (7.5) = 0.75 hr

Local usage = (90.) (7.5) = 6.75 hr

Remote CCS = (0.75) (36) = 27 CCS

Local CCS = (6.75) (36) = 243 CCS

Each terminal requires an ADM. The remote traffic would use a modem pool. The local traffic would use hunting for computer ports, each port with an ADM.

A 15 minute average queuing delay gives D/HT = 0.5.

Using Table 17, 2 ADMs are required for the remote modem pool and 7 ADMs are required for local.

Therefore, a total of 9 ADMs are required.

CASE 4

Assume

A customer has 32 terminals accessing 16 computer ports. Each terminal generates about 12 CCS during the busy hour.

Problem

Determine the expected blockage when queuing is not used.

Solution

Total offered CCS = (32 terminals) (12 CCS) = 384 CCS

Because there are tables for only 30 and 35 terminals in the source, we must interpolate.

A summary of the CCS values for 16 ports from Tables 12 and 13 are:

Number in source	P.01	P.02
35	360.0	391.9
30	369.2	400.4

Interpolation between 30 and 35 (that is, two-fifths of the difference between the two values) gives

32	365.5	397.0

Because 384 CCS lies between 365.5 CCS and 397.0 CCS, the blockage probability will lie between P.01 and P.02. Interpolating again between P.01 and P.02 gives

384 – 365.5 / 397 – 365.5 = X – .01 / .02 – .01

.587 = X – .01 / .01

Therefore, X = .01 + (.587) (.01) = .0159

X is the expected blockage.

Note: The actual blockage value is .0154.

CASE 5

Assume

Use the information in Case 4 (that is, 16 computer ports and 12 CCS per terminal).

Problem

How many terminals can be supported if

1 Blockage is allowed to increase to P.05?

2 Ring Again is used, and the average delay is twice the call holding time?

Solution

Divide the total CCS by 12 CCS, and compare the result with the entries in our tables at the given GOS and the number in source for 16 ports.

1 Use the following:

Table	Number in source	CCS at P.05	Number of terminals
10	25	467	38.9
11	30	455	38.0
12	35	448	37.3
13	40	443	36.9
14	45	439	36.6
15	50	436	36.4

The number in the source matches the number of terminals at about 37 terminals. Therefore, approximately 37 terminals can be supported at a P.05 GOS.

2 Using the queuing finite tables for 2.00 and for 16 computer ports, 576 CCS can be offered (and carried).

Therefore, the number of terminals that can be supported is 576 / 12 = 48.

By looking at Tables 24 and 25, we see that the 576 CCS value occurs for 1.00, 2.00, and 4.00 (for 16 ports). The CCS value for 0.75 is almost 576 CCS. This means that the maximum average delay experienced by 45 or 50 terminals is just over 75 of the average holding time. Once a group of circuits or ports is at full capacity, this capacity cannot be increased (576 CCS = 16 ports x 36 CCS).

Table 3
CCS capacities per loop (Part 1 of 3)

	Number of loops							
Blockage (GOS)	**2**	**3**	**4**	**5**	**6**	**7**	**9**	**12**
0.0025	488	503	511	518	523	526	531	536
0.0050	520	535	544	550	554	557	562	566
0.0075	540	555	564	570	574	577	582	586
0.0100	555	570	579	585	589	592	596	600
0.0125	567	582	591	597	601	604	608	612
0.0150	578	592	601	607	611	614	618	622
0.0175	587	601	610	615	619	622	626	630
0.0200	594	609	618	623	627	630	634	638
0.0225	602	616	625	630	634	637	641	645
0.0250	608	623	631	637	640	643	647	651
0.0275	614	629	637	643	646	649	653	657
0.0300	620	634	643	648	652	655	659	662
0.0325	625	639	648	653	657	660	664	667
0.0350	630	644	653	658	662	665	668	672
0.0375	634	649	657	663	666	669	673	676
0.0400	639	653	662	667	671	673	677	681

Table 3
CCS capacities per loop (Part 2 of 3)

Blockage (GOS)	Number of loops							
	2	3	4	5	6	7	9	12
0.0425	643	657	666	671	675	677	681	685
0.0450	647	661	670	675	679	681	685	688
0.0475	651	665	673	679	682	685	689	692
0.0500	654	669	677	682	686	689	692	696
0.0525	658	672	681	686	689	692	696	699
0.0550	661	676	684	689	693	695	699	702
0.0575	664	679	687	692	696	699	702	706
0.0600	667	682	690	696	699	702	705	709
0.0625	671	685	693	699	702	705	708	712
0.0650	674	688	696	701	705	708	711	714
0.0675	676	691	699	704	708	711	714	717
0.0700	679	694	702	707	711	713	717	720
0.0725	682	697	705	710	713	716	719	723
0.0750	685	699	707	712	716	719	722	725
0.0775	687	702	710	715	719	721	725	728

Table 3
CCS capacities per loop (Part 3 of 3)

Blockage (GOS)	Number of loops							
	2	3	4	5	6	7	9	12
0.0800	690	704	712	717	721	724	727	730
0.0825	692	707	715	720	723	726	729	733
0.0850	695	709	717	722	726	728	732	735
0.0875	697	711	720	725	728	731	734	737
0.0900	699	714	722	727	730	733	736	739
0.0925	701	716	724	729	733	735	739	742
0.0950	704	718	726	731	735	737	741	744
0.0975	706	720	728	733	737	739	743	746
0.1000	708	723	731	736	739	742	745	748

Note: This table lists average values; these values may vary according to specific user requirements.

Table 4
Service facility use—with no queuing (ERLANG B) (IN CCS) (Part 1 of 9)

	Grade of service (GOS)—traffic offered					
Number	**0.005**	**0.010**	**0.020**	**0.030**	**0.050**	**0.100**
1	0.2	0.4	0.7	1.1	1.9	4.0
2	3.8	5.5	8.0	10.1	13.7	21.4
3	12.6	16.4	21.7	25.7	32.4	45.7
4	25.2	31.3	39.3	45.3	54.9	73.6
5	40.8	49.0	59.7	67.5	79.9	103.7
6	58.4	68.7	81.9	91.5	106.6	135.3
7	77.7	90.0	105.7	117.0	134.6	168.0
8	98.3	112.6	130.6	143.5	163.5	201.5
9	120.0	136.2	156.4	170.9	193.3	235.7
10	142.6	160.6	183.0	199.1	223.8	270.4
11	166.0	185.8	210.3	227.8	254.8	305.5
12	190.0	211.5	238.1	257.1	286.2	341.1
13	214.7	237.9	266.5	286.8	318.1	376.9
14	239.9	264.7	295.2	316.9	350.3	413.0
15	265.5	291.9	324.3	347.4	382.8	449.4
16	291.6	319.5	353.8	378.2	415.6	486.0
17	318.0	347.5	383.6	409.3	448.6	522.8
18	344.8	375.7	413.7	440.6	481.9	559.7
19	371.9	404.3	444.0	472.1	515.3	596.8
20	399.3	433.1	474.5	503.9	549.0	634.1
21	427.0	462.2	505.3	535.9	582.8	671.4

Table 4
Service facility use—with no queuing (ERLANG B) (IN CCS) (Part 2 of 9)

	Grade of service (GOS)—traffic offered					
Number	**0.005**	**0.010**	**0.020**	**0.030**	**0.050**	**0.100**
22	454.9	491.4	536.3	568.0	616.8	708.9
23	483.0	520.9	567.4	600.3	650.9	746.5
24	511.3	550.6	598.7	632.8	685.1	784.2
25	539.9	580.5	630.2	665-4	719.5	822.0
26	568.6	610.5	661.8	698.1	753.9	859.9
27	597.5	640.7	693.5	731.0	788.5	897.8
28	626.6	671.1	725.4	764.0	823.2	935.8
29	655.8	701.5	757.4	797.0	858.0	973.9
30	685.2	732.1	789.5	830.2	892.9	1012.1
31	714.7	762.9	821.8	863.5	927.8	1050.3
32	744.4	793.7	854.1	896.9	962.8	1088.5
33	774.2	824.7	886.5	930.4	997.9	1126.8
34	804.1	855.8	919.0	963.9	1033.1	1165.2
35	834.1	887.0	951.7	997.6	1068.4	1203.6
36	864.2	918.3	984.4	1031.3	1103.7	1242.1
37	894.5	949.6	1017.1	1065.1	1139.0	1280.6
38	924.8	981.1	1050.0	1098.9	1174.4	1319.1
39	955.2	1012.6	1082.9	1132.8	1209.9	1357.7
40	985.7	1044.3	1115.9	1166.8	1245.5	1396.4
41	1016.3	1076.0	1149.0	1200.9	1281.0	1435.0
42	1047.0	1107.8	1182.1	1235.0	1316.7	1473.7

Table 4
Service facility use—with no queuing (ERLANG B) (IN CCS) (Part 3 of 9)

	Grade of service (GOS)—traffic offered					
Number	**0.005**	**0.010**	**0.020**	**0.030**	**0.050**	**0.100**
43	1077.8	1139.6	1215.3	1269.1	1352.3	1512.4
44	1108.7	1171.6	1248.5	1303.3	1388.1	1551.2
45	1139.6	1203.5	1281.8	1337.6	1423.8	1589.9
46	1170.6	1235.6	1315.2	1371.9	1459.6	1628.7
47	1201.7	1267.7	1348.6	1406.2	1495.5	1667.6
48	1232.8	1299.9	1382.1	1440.6	1531.3	1706.4
49	1264.1	1332.2	1415.6	1475.1	1567.2	1745.3
50	1295.3	1364.5	1449.2	1509.6	1603.2	1784.2
51	1326.7	1396.8	1482.8	1544.1	1639.2	1823.2
52	1358.1	1429.2	1516.5	1578.7	1675.2	1862.1
53	1389.6	1461.7	1550.2	1613.3	1711.2	1901.1
54	1421.1	1494.2	1583.9	1647.9	1747.3	1940.1
55	1452.6	1526.7	1617.7	1682.6	1783.4	1979.1
56	1484.2	1559.3	1651.5	1717.3	1819.6	2018.1
57	1515.9	1592.0	1685.4	1752.1	1855.7	2057.2
58	1547.6	1624.7	1719.3	1786.9	1891.9	2096.3
59	1579.4	1657.4	1753.2	1821.7	1928.1	2135.3
60	1611.2	1690.2	1787.2	1856.5	1964.4	2174.4
61	1643.1	1723.0	1821.2	1891.4	2000.6	2213.6
62	1675.0	1755.9	1855.2	1926.3	2036.9	2252.7
63	1707.0	1788.7	1889.3	1961.2	2073.2	2291.9

Table 4
Service facility use—with no queuing (ERLANG B) (IN CCS) (Part 4 of 9)

	Grade of service (GOS)—traffic offered					
Number	**0.005**	**0.010**	**0.020**	**0.030**	**0.050**	**0.100**
64	1739.0	1821.7	1923.4	1996.2	2109.6	2331.0
65	1771.0	1854.7	1957.5	2031.2	2145.9	2370.2
66	1803.1	1887.7	1991.7	2066.2	2182.3	2409.4
67	1835.2	1920.7	2025.9	2101.2	2218.7	2448.6
68	1867.4	1953.8	2060.1	2136.3	2255.1	2487.8
69	1899.6	1986.9	2094.4	2171.4	2291.6	2527.0
70	1931.8	2020.0	2128.7	2206.5	2328.0	2566.3
71	1964.1	2053.2	2163.0	2241.6	2364.5	2605.5
72	1996.4	2086.4	2197.3	2276.8	2401.0	2644.8
73	2028.7	2119.7	2231.6	2312.0	2437.5	2684.1
74	2061.1	2152.9	2266.0	2347.2	2474.0	2723.4
75	2093.5	2186.2	2300.4	2382.4	2510.6	2762.7
76	2126.0	2219.5	2334.8	2417.6	2547.1	2802.0
77	2158.4	2242.9	2369.3	2452.9	2483.7	2841.3
78	2190.9	2286.2	2403.8	2488.2	2620.3	2880.6
79	2223.5	2319.6	2438.3	2523.5	2656.9	2920.0
80	2256.0	2353.1	2472.8	2558.8	2693.5	2959.3
81	2288.6	2386.5	2507.3	2594.1	2730.2	2998.7
82	2321.3	2420.0	2541.9	2629.9	2766.8	3038.0
83	2353.9	2453.5	2576.4	2664.9	2803.5	3077.4
84	2386.6	2487.0	2611.0	2700.2	2840.2	3116.8

Table 4
Service facility use—with no queuing (ERLANG B) (IN CCS) (Part 5 of 9)

	Grade of service (GOS)—traffic offered					
Number	**0.005**	**0.010**	**0.020**	**0.030**	**0.050**	**0.100**
85	2419.3	2520.6	2645.7	2735.7	2876.8	3156.2
86	2452.0	2554.1	2680.3	2771.1	2913.6	3195.6
87	2484.8	2587.7	2714.9	2806.5	2950.3	3235.0
88	2517.6	2621.3	2749.6	2842.0	2987.0	3274.4
89	2550.4	2655.0	2784.3	2877.5	3023.7	3313.8
90	2583.2	2688.6	2819.0	2912.9	3060.5	3353.3
91	2616.1	2722.3	2853.7	2984.4	3097.3	3392.7
92	2648.9	2756.0	2888.5	2984.0	3134.0	3432.2
93	2681.8	2789.7	2923.2	3019.5	3170.8	3471.6
94	2714.8	2823.5	2958.0	3055.0	3207.6	3511.1
95	2747.7	2857.2	2992.8	3090.6	3244.4	3550.5
96	2780.7	2891.0	3027.6	3126.2	3281.3	3590.0
97	2813.7	2924.8	3062.4	3161.8	3318.1	3629.5
98	2846.7	2958.6	3097.3	3197.4	3354.9	3669.0
99	2879.7	2992.5	3132.1	3233.0	3391.8	3708.5
100	2912.8	3026.3	3167.0	3268.6	3428.7	3748.0
101	2945.9	3060.2	3201.9	3304.2	3465.5	3787.5
102	2978.9	3094.1	3236.8	3339.9	3502.4	3827.0
103	3012.1	3128.0	3271.7	3375.5	3539.3	3866.5
104	3045.2	3161.9	3306.6	3411.2	3576.2	3906.0
105	3078.3	3195.8	3341.5	3446.9	3613.1	3945.5

Table 4
Service facility use—with no queuing (ERLANG B) (IN CCS) (Part 6 of 9)

	Grade of service (GOS)—traffic offered					
Number	**0.005**	**0.010**	**0.020**	**0.030**	**0.050**	**0.100**
106	3111.5	3229.8	3376.5	3482.6	3650.0	3985.0
107	3144.7	3263.8	3411.5	3518.3	3687.0	4024.6
108	3177.9	3297.7	3446.4	3554.0	3723.9	4064.1
109	3211.2	3331.7	3481.4	3589.7	3760.8	4103.7
110	3244.4	3365.8	3516.4	3625.5	3797.8	4143.2
111	3277.7	3399.8	3551.4	3661.2	3834.8	4182.8
112	3310.9	3433.8	3586.5	3697.0	3871.7	4222.3
113	3344.2	3467.9	3621.5	3732.8	3908.7	4261.9
114	3377.6	3502.0	3656.6	3768.5	3945.7	4301.5
115	3410.9	3536.1	3691.6	3804.3	3982.7	4341.0
116	3444.2	3570.2	3726.7	3840.1	4019.7	4380.6
117	3477.6	3604.3	3761.8	3875.9	4056.7	4420.2
118	3511.0	3638.4	3796.9	3911.8	4093.7	4459.8
119	3544.4	3672.6	3832.0	3947.6	4130.7	4499.4
120	3577.8	3706.7	3867.1	3983.4	4167.7	4539.0
121	3611.2	3740.9	4902.2	4019.3	4204.8	4578.6
122	3644.6	3775.1	3937.4	4055.1	4241.8	4618.2
123	3678.1	3809.3	3972.5	4091.0	4278.9	4657.8
124	3711.6	3843.5	4007.7	4126.9	4315.9	4697.4
125	3745.0	3877.7	4042.8	4162.7	4353.0	4737.0
126	3778.5	3911.9	4078.0	4198.6	4390.1	4776.6

Table 4
Service facility use—with no queuing (ERLANG B) (IN CCS) (Part 7 of 9)

	Grade of service (GOS)—traffic offered					
Number	**0.005**	**0.010**	**0.020**	**0.030**	**0.050**	**0.100**
127	3812.0	3946.2	4113.2	4234.5	4427.1	4816.2
128	3845.6	3980.4	4148.4	4270.4	4464.2	4855.9
129	3879.1	4014.7	4183.6	4306.4	4501.3	4895.5
130	3912.7	4049.0	4218.8	4342.3	4538.4	4935.1
131	3946.2	4083.2	4254.0	4378.2	4575.5	4974.7
132	3979.8	4117.5	4289.3	4414.2	4612.6	5014.4
133	4013.4	4151.9	4324.5	4450.1	4649.7	5054.0
134	4047.0	4186.2	4359.8	4486.1	4686.8	5093.7
135	4080.6	4220.5	4395.0	4522.0	4724.0	5133.3
136	4114.2	4254.9	4430.3	4558.0	4761.1	5173.0
137	4147.9	4289.2	4465.6	4594.0	4798.2	5212.6
138	4181.5	4323.6	4500.9	4629.9	4835.4	5252.3
139	4215.2	4358.0	4536.1	4665.9	4872.5	5291.9
140	4248.9	4392.3	4571.4	4701.9	4909.7	5331.6
141	4282.6	4426.7	4606.8	4737.9	4946.8	5371.3
142	4316.3	4461.1	4642.1	4773.9	4984.0	5411.0
143	4350.0	4495.6	4677.4	4810.0	5021.1	5450.6
144	4383.7	4530.0	4712.7	4846.0	5058.3	5490.3
145	4417.4	4564.4	4748.1	4882.0	5095.5	5530.0
146	4451.2	4598.9	4783.4	4918.1	5132.7	5569.7
147	4484.9	4633.3	4818.8	4954.1	5169.8	5609.3

Table 4
Service facility use—with no queuing (ERLANG B) (IN CCS) (Part 8 of 9)

	Grade of service (GOS)—traffic offered					
Number	**0.005**	**0.010**	**0.020**	**0.030**	**0.050**	**0.100**
148	4518.7	4667.8	4854.2	4990.1	5207.0	5649.0
149	4552.5	4702.3	4889.5	5026.2	5244.2	5688.7
150	4586.3	4736.7	4924.9	5062.3	5281.4	5728.4
151	4620.1	4771.2	4960.3	5098.3	5318.6	5768.1
152	4653.9	4805.7	4995.7	5134.4	5355.8	5807.8
153	4687.7	4840.2	5031.1	5170.5	5393.1	5847.5
154	4721.5	4874.8	5066.5	5206.6	5430.3	5887.2
155	4755.4	4909.3	5101.9	5242.7	5467.5	5926.9
156	4789.2	4943.8	5137.3	5278.8	5504.7	5966.6
157	4823.1	4978.4	5172.8	5314.9	5541.9	6006.3
158	4857.0	5012.9	5208.2	5351.0	5579.2	6046.0
159	4890.8	5047.5	5243.6	5387.1	5616.4	6085.7
160	4924.7	5082.0	5279.1	5423.2	5653.7	6125.4
161	4958.6	5116.6	5314.6	5459.3	5690.9	
162	4992.5	5151.2	5350.0	5495.5	5728.2	
163	5026.5	5185.8	5385.5	5531.6	5765.4	
164	5060.4	5220.4	5421.0	5567.7	5802.7	
165	5094.3	5255.0	5456.4	5603.9	5839.9	

Table 4
Service facility use—with no queuing (ERLANG B) (IN CCS) (Part 9 of 9)

	Grade of service (GOS)—traffic offered					
Number	**0.005**	**0.010**	**0.020**	**0.030**	**0.050**	**0.100**
166	5128.3	5289.6	5491.9	5640.0	5877.2	
167	5162.2	5324.2	5527.4	5676.2	5914.5	
168	5196.2	5358.9	5562.9	5712.4	5951.7	
169	5230.2	5393.5	5598.4	5748.5	5989.0	
170	5264.1	5428.1	5633.9	5784.7	6026.3	
171	5298.1	5462.8	5669.4	5820.9	6063.6	
172	5332.1	5497.5	5705.0	5857.1	6100.9	
173	5366.1	5532.1	5740.5	5893.2	6138.2	
174	5400.2	5566.8	5776.0	5929.4	6175.5	
175	5434.2	5601.5	5811.6	5965.6	6212.8	

Table 5
Service facility use—with queuing (ERLANG C) (in CCS) (delay over all calls) (Part 1 of 8)

	Delay/holding time (D/HT)—traffic offered					
Number	**0.25**	**0.50**	**0.75**	**1.00**	**2.00**	**4.00**
1	7.2	12.0	15.4	18.0	24.0	23.8
2	32.2	41.6	47.1	50.9	58.8	64.4
3	61.9	74.1	80.9	85.3	94.2	100.2
4	93.3	107.6	115.3	120.2	129.8	136.1
5	125.8	141.8	150.2	155.4	165.5	172.0
6	158.9	176.3	185.2	190.8	201.3	207.9
7	192.5	211.1	220.5	226.3	237.1	243.9
8	226.4	246.0	255.8	261.8	272.9	279.8
9	260.5	281.1	291.3	297.5	308.8	315.8
10	294.8	316.3	326.8	333.1	344.7	351.7
11	329.3	351.6	362.4	368.9	380.6	387.7
12	363.9	386.9	398.0	404.6	416.5	423.7
13	398.6	422.3	433.6	440.4	452.4	459.7
14	433.5	457.8	469.3	476.1	488.4	495.6
15	468.3	493.2	505.0	511.9	524.3	531.6
16	503.3	528.8	540.7	547.8	560.2	567.6
17	528.3	564.3	576.5	583.6	596.2	603.6
18	573.4	599.9	612.2	619.4	632.1	639.6
19	608.6	635.5	648.0	655.3	668.1	675.6
20	643.8	671.2	683.8	691.2	704.0	711.5
21	679.0	706.8	719.6	727.0	740.0	747.5

Table 5
Service facility use—with queuing (ERLANG C) (in CCS) (delay over all calls) (Part 2 of 8)

	Delay/holding time (D/HT)—traffic offered					
Number	**0.25**	**0.50**	**0.75**	**1.00**	**2.00**	**4.00**
22	714.3	742.5	755.4	762.9	776.0	783.5
23	749.6	778.2	791.2	798.8	811.9	819.5
24	784.9	813.9	827.1	834.7	847.9	855.5
25	820.3	849.6	862.9	870.6	883.9	891.5
26	855.6	885.4	898.8	906.5	919.8	927.5
27	891.0	921.1	934.6	942.4	955.8	963.5
28	926.5	956.9	970.5	978.3	991.8	999.5
29	961.9	992.6	1006.4	1014.2	1027.7	1035.5
30	997.4	1028.4	1042.2	1050.2	1063.7	1071.5
31	1032.9	1064.2	1078.1	1086.1	1099.7	1107.5
32	1068.4	1100.0	1114.0	1122.0	1135.7	1143.4
33	1103.9	1135.8	1149.9	1157.9	1171.7	1179.4
34	1139.5	1171.6	1185.8	1193.9	1207.6	1215.4
35	1175.0	1207.4	1221.7	1229.8	1243.6	1251.4
36	1210.6	1243.2	1257.6	1265.7	1279.6	1287.4
37	1246.2	1297.1	1293.5	1301.7	1316.5	1323.4
38	1281.8	1314.9	1329.4	1337.6	1351.6	1359.4
39	1317.4	1350.7	1365.3	1373.6	1387.5	1395.4
40	1353.0	1386.6	1401.2	1409.5	1423.5	1431.4
41	1388.6	1422.4	1437.1	1445.5	1459.4	1467.4
42	1424.2	1458.3	1473.0	1481.4	1495.5	1503.4

Table 5
Service facility use—with queuing (ERLANG C) (in CCS) (delay over all calls) (Part 3 of 8)

	Delay/holding time (D/HT)—traffic offered					
Number	**0.25**	**0.50**	**0.75**	**1.00**	**2.00**	**4.00**
43	1459.9	1494.1	1509.0	1517.4	1531.5	1539.4
44	1495.5	1530.0	1544.9	1553.3	1567.5	1575.4
45	1531.2	1565.8	1580.8	1589.3	1603.4	1611.4
46	1566.8	1601.7	1616.8	1625.2	1639.4	1647.4
47	1602.5	1637.6	1652.7	1661.2	1675.4	1683.4
48	1638.2	1673.5	1688.6	1697.1	1711.4	1719.4
49	1673.9	1709.3	1724.5	1733.1	1747.4	1755.4
50	1709.6	1745.2	1760.5	1769.0	1783.4	1791.4
51	1745.3	1781.1	1796.4	1805.0	1819.4	1827.4
52	1781.0	1817.0	1832.4	1841.0	1855.4	1863.4
53	1816.7	1852.9	1868.3	1876.9	1891.3	1899.4
54	1852.5	1888.8	1904.2	1912.9	1927.3	1935.4
55	1888.2	1924.6	1940.2	1948.9	1963.3	1971.3
56	1923.9	1960.5	1976.1	1984.8	1999.3	2007.3
57	1959.7	1996.4	2012.1	2020.8	2035.3	2043.3
58	1995.4	2032.3	2048.0	2056.8	2071.3	2079.3
59	2031.2	2068.2	2084.0	2092.7	2107.3	2115.3
60	2066.9	2104.1	2119.9	2128.7	2143.3	2151.3
61	2102.7	2140.1	2155.9	2164.7	2179.3	2187.3
62	2138.4	2175.9	2191.8	2200.6	2215.3	2223.3
63	2174.2	2211.9	2227.8	2236.6	2251.3	2259.3

Table 5
Service facility use—with queuing (ERLANG C) (in CCS) (delay over all calls) (Part 4 of 8)

	Delay/holding time (D/HT)—traffic offered					
Number	**0.25**	**0.50**	**0.75**	**1.00**	**2.00**	**4.00**
64	2209.9	2247.8	2263.7	2272.6	2287.2	2295.3
65	2245.8	2283.7	2299.7	2308.5	2323.2	2331.3
66	2218.5	2319.6	2335.6	2344.5	2359.2	2367.3
67	2317.3	2355.5	2371.6	2380.5	2395.2	2403.3
68	2353.1	2391.4	2407.5	2416.5	2431.2	2439.3
69	2388.9	2427.3	2443.5	2452.4	2467.2	2475.3
70	2424.7	2463.3	2479.4	2488.4	2503.2	2511.3
71	2460.5	2499.2	2515.4	2524.4	2539.2	2547.3
72	2496.3	2535.1	2551.4	2560.4	2575.2	2583.3
73	2531.1	2571.0	2587.3	2596.3	2611.2	2619.3
74	2567.9	2607.0	2623.3	2632.3	2647.2	2655.3
75	2603.7	2642.9	2659.2	2668.3	2683.2	2691.3
76	2639.5	2678.8	2695.2	2704.3	2719.2	2727.3
77	2675.3	2714.7	2731.2	2740.2	2755.1	2763.3
78	2711.1	2750.7	2767.1	2776.2	2791.1	2799.3
79	2746.9	2786.6	2803.1	2812.2	2827.1	2835.3
80	2782.7	2822.5	2839.1	2848.2	2863.1	2871.3
81	2818.6	2858.5	2875.0	2384.1	2899.1	2907.3
82	2854.4	2894.4	2911.0	2920.1	2935.1	2943.3
83	2890.2	2930.4	2947.0	2956.1	2971.1	2979.3
84	2926.1	2966.3	2982.9	2992.1	3007.1	3015.3

Table 5
Service facility use—with queuing (ERLANG C) (in CCS) (delay over all calls) (Part 5 of 8)

	Delay/holding time (D/HT)—traffic offered					
Number	**0.25**	**0.50**	**0.75**	**1.00**	**2.00**	**4.00**
85	2961.9	3002.2	3018.9	3028.1	3043.1	3051.3
86	2997.7	3038.2	3054.9	3064.0	3079.1	3087.3
87	3033.6	3074.1	3090.8	3100.0	3115.1	3123.3
88	3069.4	3110.0	3126.8	3136.0	3151.1	3159.3
89	3105.2	3146.0	3162.8	3172.0	3187.1	3195.3
90	3141.1	3181.9	3198.7	3208.0	3223.1	3231.3
91	3176.9	3217.9	3234.7	3243.9	3259.1	3267.3
92	3212.8	3253.8	3270.7	3279.9	3295.1	3303.3
93	3248.7	3289.8	3306.6	3315.9	3331.1	3339.3
94	3284.5	3325.7	3342.6	3351.9	3367.0	3375.3
95	3320.3	3361.6	3378.6	3387.9	3403.0	3411.3
96	3356.2	3397.6	3414.6	3423.9	3439.0	3447.3
97	3392.1	3433.6	3450.5	3459.8	3475.0	3483.3
98	3427.9	3469.5	3486.5	3495.8	3511.0	3919.3
99	3463.8	3505.4	3522.5	3531.8	3547.0	3555.3
100	3499.6	3541.4	3558.5	3567.8	3583.0	3591.3
101	3535.5	3577.3	3594.4	3603.8	3619.0	3627.3
102	3571.4	3613.3	3630.4	3639.8	3655.0	3663.3
103	3607.3	3649.2	3666.4	3675.7	3691.0	3699.3
104	3643.1	3685.2	3702.3	3711.7	3727.0	3735.3
105	3679.0	3721.1	3738.3	3747.7	3763.0	3771.3

Table 5
Service facility use—with queuing (ERLANG C) (in CCS) (delay over all calls) (Part 6 of 8)

	Delay/holding time (D/HT)—traffic offered					
Number	**0.25**	**0.50**	**0.75**	**1.00**	**2.00**	**4.00**
106	3714.8	3757.1	3774.3	3783.7	3799.0	3807.3
107	3750.7	3793.1	3810.3	3819.7	3835.0	3843.3
108	3786.6	3829.0	3846.3	3855.7	3871.0	3879.3
109	3822.5	3865.0	3882.2	3891.7	3907.0	3915.3
110	3858.3	3900.9	3918.2	3927.6	3943.0	3951.3
111	3894.2	3936.9	3954.2	3963.6	3979.0	3987.3
112	3930.1	3972.8	3990.2	3999.6	4015.0	4023.3
113	3966.0	4008.8	4026.1	4035.6	4051.0	4059.2
114	4001.9	4044.7	4062.1	4071.6	4087.0	4095.2
115	4037.8	4080.7	4098.1	4107.6	4123.0	4131.2
116	4073.6	4116.6	4134.1	4143.6	4158.9	4167.2
117	4109.5	4152.1	4170.1	4179.5	4194.9	4203.2
118	4145.4	4188.6	4206.0	4215.5	4230.9	4239.2
119	4181.3	4224.5	4242.0	4251.5	4266.9	4275.2
120	4217.2	4260.5	4278.0	4287.5	4302.9	4311.2
121	4253.1	4296.4	4314.0	4323.5	4338.9	4347.2
122	4289.0	4332.4	4349.9	4359.5	4374.9	4383.2
123	4324.9	4368.4	4385.9	4395.5	4410.9	4419.2
124	4360.7	4404.3	4421.9	4431.5	4446.9	4455.2
125	4396.6	4440.3	4457.9	4467.4	4482.0	4491.2
126	4432.5	4476.3	4493.9	4503.4	4518.9	4527.2

Table 5
Service facility use—with queuing (ERLANG C) (in CCS) (delay over all calls) (Part 7 of 8)

	Delay/holding time (D/HT)—traffic offered					
Number	**0.25**	**0.50**	**0.75**	**1.00**	**2.00**	**4.00**
127	4468.4	4512.2	4529.9	4539.4	4554.9	4563.2
128	4504.3	4548.2	4565.8	4575.4	4590.9	4599.2
129	4540.2	4584.1	4601.8	4611.4	4626.9	4635.2
130	4576.1	4620.1	4637.8	4647.4	4662.9	4671.2
131	4612.0	4656.1	4673.8	4783.4	4698.9	4707.2
132	4647.9	4692.0	4709.8	4719.4	4734.9	4743.2
133	4683.8	4728.0	4745.7	4755.4	4770.9	4779.2
134	4719.8	4764.0	4781.7	4791.3	4806.9	4815.2
135	4755.6	4799.9	4817.7	4827.3	4842.9	4851.2
136	4791.6	4835.9	4853.7	4863.3	4878.0	4887.2
137	4827.4	4871.9	4889.7	4899.3	4914.9	4923.2
138	4863.3	4907.8	4925.7	4935.3	4950.9	4959.2
139	4899.2	4943.8	4961.6	4971.3	4986.9	4995.2
140	4935.2	4979.8	4997.6	5007.3	5022.9	5031.2

Table 5
Service facility use—with queuing (ERLANG C) (in CCS) (delay over all calls) (Part 8 of 8)

	Delay/holding time (D/HT)—traffic offered					
Number	**0.25**	**0.50**	**0.75**	**1.00**	**2.00**	**4.00**
141	4971.1	5015.7	5033.6	5043.3	5058.9	5067.2
142	5007.0	5051.7	5069.6	5079.3	5094.9	5103.2
143	5042.9	5087.7	5105.6	5115.3	5130.9	5139.2
144	5078.8	5123.6	5141.5	5151.2	5166.9	5175.2
145	5114.7	5159.6	5177.5	5187.2	5202.9	5211.2
146	5150.6	5195.6	5213.5	5223.2	5238.9	5247.2
147	5186.5	5231.5	5249.5	5259.2	5274.9	5283.2
148	5222.5	5267.5	5285.5	5295.2	5310.9	5319.2
149	5258.4	5303.5	5321.5	5331.2	5346.8	5355.2
150	5294.3	5339.4	5357.5	5367.2	5382.8	5391.2

Table 6
Service facility use—finite source with no queuing (ENGSET) (in CCS); number in source = 5

	Grade of service (GOS)—traffic offered					
Number	**0.005**	**0.010**	**0.020**	**0.030**	**0.050**	**0.100**
1	0.2	0.5	0.9	1.4	2.3	4.9
2	5.4	7.7	11.1	13.8	18.3	27.6
3	20.2	25.7	33.0	38.4	46.6	62.1
4	47.9	57.1	68.2	75.9	87.2	107.3

Table 7
Service facility use—finite source with no queuing (ENGSET) (in CCS); number in source = 10

	Grade of service (GOS)—traffic offered					
Number	**0.005**	**0.010**	**0.020**	**0.030**	**0.050**	**0.100**
1	0.2	0.4	0.8	1.2	2.1	4.4
2	4.4	6.4	9.3	11.7	15.7	24.1
3	15.3	19.8	25.9	30.5	37.8	52.2
4	32.1	39.3	48.5	55.2	65.5	85.1
5	54.1	63.7	75.8	84.4	97.4	121.5
6	80.9	92.9	107.4	117.6	132.9	160.8
7	112.9	126.9	143.5	155.0	172.1	203.1
8	151.3	167.0	185.2	197.6	215.9	249.2
9	200.4	217.1	236.2	248.9	267.7	302.1

Table 8
Service facility use—finite source with no queuing (ENGSET) (in CCS); number in source = 15

	Grade of service (GOS)—traffic offered					
Number	**0.005**	**0.010**	**0.020**	**0.030**	**0.050**	**0.100**
1	0.2	0.4	0.8	1.2	2.0	4.3
2	4.2	6.1	8.8	11.1	15.0	23.1
3	14.3	18.5	24.3	28.7	35.8	49.8
4	29.4	36.1	44.9	51.3	61.4	80.7
5	48.5	57.6	69.1	77.5	90.3	114.4
6	70.9	82.3	96.4	106.4	121.7	150.1
7	96.5	109.9	126.3	137.8	155.2	187.5
8	124.7	140.0	158.4	171.3	190.6	226.4
9	155.8	172.6	192.8	206.8	227.8	266.6
10	189.7	207.9	229.6	244.5	266.9	308.3
11	226.7	246.2	268.9	284.6	308.0	351.6
12	267.9	288.1	311.6	327.6	351.8	397.1
13	314.4	335.0	358.7	375.0	399.3	445.7
14	371.1	391.4	414.6	430.4	454.3	500.6

Table 9
Service facility use—finite source with no queuing (ENGSET) (in CCS); number in source = 20

	Grade of service (GOS)—traffic offered					
Number	**0.005**	**0.010**	**0.020**	**0.030**	**0.050**	**0.100**
1	0.2	0.4	0.8	1.2	2.0	4.2
2	4.1	5.9	8.6	10.8	14.6	22.7
3	13.8	17.9	23.6	27.9	34.8	48.7
4	28.2	34.7	43.3	49.6	59.6	78.7
5	46.2	55.1	66.4	74.6	87.3	111.4
6	67.1	78.2	92.1	102.0	117.3	145.8
7	90.6	103.7	119.9	131.4	149.0	181.7
8	116.2	131.2	149.6	162.5	182.2	218.6
9	143.8	160.5	180.9	195.1	216.6	256.6
10	173.2	191.6	213.6	229.0	252.3	295.5
11	204.4	224.2	247.8	264.2	289.0	335.2
12	237.4	258.5	283.4	300.7	326.8	375.7
13	272.3	294.4	320.5	338.5	365.8	417.1
14	309.2	332.2	359.1	377.8	406.0	459.4
15	348.4	371.9	399.6	418.7	447.6	502.8
16	390.3	414.2	442.2	461.6	491.0	547.6
17	435.7	459.7	487.7	507.1	536.7	594.3
18	486.2	509.9	537.5	556.5	585.9	644.0
19	546.9	569.5	595.7	614.0	642.4	699.8

Table 10
Service facility use—finite source with no queuing (ENGSET) (in CCS); number in source = 25

	Grade of service (GOS)—traffic offered					
Number	**0.005**	**0.010**	**0.020**	**0.030**	**0.050**	**0.100**
1	0.2	0.4	0.8	1.2	2.0	4.1
2	4.0	5.8	8.5	10.7	14.4	22.4
3	13.5	17.6	23.2	27.4	34.3	48.1
4	27.5	34.0	42.4	48.7	58.5	77.6
5	45.0	53.7	64.9	73.0	85.7	109.7
6	65.1	76.1	89.8	99.6	114.8	143.4
7	87.5	100.5	116.6	128.1	145.6	178.5
8	111.9	126.8	145.1	158.0	177.8	214.6
9	137.9	154.6	174.9	189.2	211.0	251.6
10	165.4	183.7	206.0	221.5	245.2	289.3
11	194.3	214.2	238.1	254.9	280.3	327.6
12	224.6	245.9	271.4	289.2	316.1	366.5
13	256.2	278.7	305.6	324.4	352.8	406.1
14	289.1	312.7	340.9	360.4	390.2	446.1
15	323.1	347.8	377.1	397.4	428.3	486.7
16	358.6	384.1	414.3	435.3	467.2	527.9
17	395.5	421.7	452.6	474.1	506.0	569.7
18	433.9	460.6	492.1	514.1	547.6	612.2
19	474.0	501.0	533.0	555.2	589.3	655.5
20	516.2	543.3	575.4	597.8	632.3	699.8

Table 11
Service facility use—finite source with no queuing (ENGSET) (in CCS); number in source = 30 (Part 1 of 2)

	Grade of service (GOS)—traffic offered					
Number	**0.005**	**0.010**	**0.020**	**0.030**	**0.050**	**0.100**
1	0.2	0.4	0.8	1.2	2.0	4.1
2	4.0	5.8	8.5	10.6	14.3	22.2
3	13.3	17.4	22.9	27.1	34.0	47.6
4	27.1	33.5	41.9	48.1	57.9	76.9
5	44.2	52.8	63.9	72.0	84.6	108.6
6	63.9	74.7	88.3	98.2	113.3	142.0
7	85.7	98.5	114.6	126.0	143.6	176.6
8	109.2	124.0	142.3	155.3	175.1	212.1
9	134.3	151.0	171.3	185.7	207.6	248.5
10	160.8	179.1	201.4	217.1	241.0	285.6
11	188.5	208.4	232.5	249.4	275.1	323.2
12	217.4	238.7	264.5	282.6	310.0	361.3
13	247.4	270.0	297.4	316.5	345.5	399.9
14	278.2	302.2	331.0	351.1	381.6	439.0
15	310.2	335.2	365.3	386.3	418.2	478.4

Table 11
Service facility use—finite source with no queuing (ENGSET) (in CCS); number in source = 30 (Part 2 of 2)

	Grade of service (GOS)—traffic offered					
Number	**0.005**	**0.010**	**0.020**	**0.030**	**0.050**	**0.100**
16	343.0	369.2	400.4	422.2	455.4	518.2
17	376.9	404.0	436.3	458.8	493.2	558.5
18	411.7	439.6	472.8	496.1	531.5	599.1
19	447.5	476.2	510.2	533.9	570.3	640.2
20	484.4	513.6	548.3	572.6	609.8	681.6
21	522.4	552.1	587.3	611.9	649.9	723.6
22	561.5	591.6	627.2	652.2	690.7	766.1
23	602.2	632.4	668.2	693.3	732.3	809.2
24	644.4	674.5	710.3	735.5	774.0	853.1
25	688.3	718.3	754.0	779.2	818.6	897.9

Table 12
Service facility use—finite source with no queuing (ENGSET) (in CCS); number in source = 35 (Part 1 of 2)

	Grade of service (GOS)—traffic offered					
Number	**0.005**	**0.010**	**0.020**	**0.030**	**0.050**	**0.100**
1	0.2	0.4	0.8	1.1	1.9	4.1
2	4.0	5.7	8.4	10.5	14.2	22.1
3	13.2	17.2	22.7	26.9	33.7	47.4
4	26.8	33.2	41.5	47.7	57.4	76.4
5	43.7	52.2	63.3	71.3	83.9	107.9
6	63.0	73.8	87.3	97.1	112.3	140.9
7	84.4	97.2	113.2	124.6	142.2	175.2
8	107.5	122.2	140.4	153.4	173.2	210.5
9	132.0	148.5	168.0	183.3	205.3	246.4
10	157.8	176.1	198.4	214.1	238.2	283.1
11	184.7	204.6	228.8	245.8	271.7	320.3
12	212.7	234.1	260.0	278.2	306.0	357.9
13	241.6	264.4	292.0	311.3	340.8	396.0
14	271.4	295.6	324.7	345.1	376.1	434.4
15	302.1	327.4	358.0	379.3	411.9	473.2
16	333.5	360.0	391.9	414.2	448.1	512.3
17	365.8	393.3	426.4	449.5	484.8	551.7
18	398.7	427.3	461.5	485.4	521.9	591.5
19	432.5	461.9	497.1	521.8	559.5	631.5
20	467.0	497.3	533.4	558.7	597.4	671.8

Table 12
Service facility use—finite source with no queuing (ENGSET) (in CCS); number in source = 35 (Part 2 of 2)

	Grade of service (GOS)—traffic offered					
Number	**0.005**	**0.010**	**0.020**	**0.030**	**0.050**	**0.100**
21	502.3	533.2	570.2	596.1	635.8	712.5
22	538.4	569.9	607.6	634.0	674.6	753.4
23	575.2	607.3	645.5	672.4	713.9	794.7
24	712.9	645.5	684.2	711.5	753.6	836.3
25	651.7	684.4	723.5	751.1	793.9	878.3
26	691.4	724.3	763.6	791.4	834.8	920.8
27	732.1	765.2	804.6	832.5	876.2	963.7
28	774.2	807.1	846.5	874.5	918.5	1007.2
29	817.7	850.4	889.6	917.5	961.7	1051.5
30	863.0	895.3	934.1	961.8	1005.9	1096.6

Table 13
Service facility use—finite source with no queuing (ENGSET) (in CCS); number in source = 40 (Part 1 of 2)

	Grade of service (GOS)—traffic offered					
Number	**0.005**	**0.010**	**0.020**	**0.030**	**0.050**	**0.100**
1	0.2	0.4	0.8	1.1	1.9	4.1
2	3.9	5.7	8.3	10.5	14.2	22.0
3	13.2	17.1	22.6	26.8	33.6	47.2
4	26.6	32.9	41.2	47.3	57.1	76.1
5	43.3	51.8	62.8	70.8	83.3	107.3
6	62.4	73.1	86.6	96.4	111.5	140.2
7	83.5	96.2	112.1	123.5	141.1	174.2
8	106.2	120.8	139.1	152.0	171.9	209.2
9	130.3	146.8	167.1	181.6	203.6	245.0
10	155.6	173.8	196.2	212.0	236.1	281.3
11	182.0	201.9	226.1	243.2	269.3	318.2
12	209.3	230.8	256.8	275.2	303.1	355.5
13	237.6	260.5	288.2	307.7	337.5	393.2
14	266.7	290.9	320.3	340.9	372.2	431.2
15	296.5	322.0	352.9	374.5	407.5	469.6
16	327.0	353.7	386.0	408.7	443.1	508.3
17	358.2	386.1	419.7	443.3	479.2	547.2
18	390.1	419.1	453.9	478.3	515.6	586.4
19	422.6	452.5	488.5	513.8	552.3	625.8
20	455.7	486.6	523.7	549.6	589.4	665.5

Table 13
Service facility use—finite source with no queuing (ENGSET) (in CCS); number in source = 40 (Part 2 of 2)

	Grade of service (GOS)—traffic offered					
Number	**0.005**	**0.010**	**0.020**	**0.030**	**0.050**	**0.100**
21	489.5	521.1	559.2	585.9	626.9	705.4
22	523.8	556.3	595.3	622.6	664.6	745.5
23	558.8	592.0	631.7	659.7	702.7	785.9
24	594.4	628.2	668.7	697.1	741.1	826.5
25	630.6	665.0	706.1	735.1	779.8	867.4
26	667.6	702.3	744.0	773.4	819.0	908.5
27	705.1	740.3	782.4	812.2	858.5	949.9
28	743.5	778.9	821.3	851.5	898.4	991.6
29	782.5	818.2	860.9	891.2	938,7	1033.6
30	822.6	858.2	901.1	931.6	979.6	1076.0
31	863.4	899.1	941.9	972.6	1020.9	1118.7
32	905.3	940.9	983.7	1014.3	1062.9	1162.0
33	948.4	983.7	1026.3	1056.9	1105.6	1205.8
34	993.0	1027.9	1070.0	1100.4	1149.1	1250.3
35	1039.3	1073.5	1115.1	1145.3	1193.8	1295.6

Table 14
Service facility use—finite source with no queuing (ENGSET) (in CCS); number in source = 45 (Part 1 of 2)

	Grade of service (GOS)—traffic offered					
Number	**0.005**	**0.010**	**0.020**	**0.030**	**0.050**	**0.100**
1	0.2	0.4	0.8	1.1	1.9	4.1
2	3.9	5.7	8.3	10.4	14.1	22.0
3	13.1	17.0	22.5	26.6	33.4	47.0
4	26.5	32.7	41.0	47.1	56.8	75.8
5	43.0	41.5	62.4	70.4	82.9	106.9
6	61.9	72.6	86.0	95.8	110.9	139.6
7	82.8	95.4	111.4	122.8	140.4	173.5
8	105.2	119.9	138.0	151.0	170.9	208.3
9	129.0	145.5	165.8	180.2	202.4	243.8
10	154.0	172.2	194.6	210.4	234.6	280.0
11	179.9	199.9	224.1	241.3	267.5	316.6
12	206.9	228.4	254.5	272.9	301.0	353.7
13	234.6	257.6	285.5	305.1	335.0	391.1
14	263.1	287.5	317.0	337.8	369.4	428.9
15	292.4	318.1	349.2	371.0	404.3	467.0
16	322.3	349.2	381.8	404.6	439.5	505.3
17	352.7	380.9	414.9	438.7	475.1	543.9
18	383.9	413.2	448.4	473.2	511.0	582.7
19	415.5	445.9	482.4	508.0	547.2	621.8
20	447.6	479.0	516.8	543.2	583.8	661.0

Table 14
Service facility use—finite source with no queuing (ENGSET) (in CCS); number in source = 45 (Part 2 of 2)

	Grade of service (GOS)—traffic offered					
Number	**0.005**	**0.010**	**0.020**	**0.030**	**0.050**	**0.100**
21	480.5	512.7	551.5	578.8	620.6	700.5
22	513.8	546.9	586.7	614.7	657.6	740.1
23	547.5	581.5	622.2	560.9	695.0	780.0
24	581.8	616.5	658.1	687.4	732.6	820.0
25	616.6	652.0	694.4	724.3	770.5	860.2
26	652.0	687.8	731.1	761.6	808.7	900.6
27	687.8	724.2	768.1	799.1	847.1	941.2
28	724.1	761.1	805.6	837.0	885.9	982.0
29	761.1	798.5	843.4	875.2	924.9	1023.0
30	798.5	836.3	881.6	913.9	964.2	1064.2
31	836.6	874.6	920.3	952.8	1003.8	1105.6
32	875.3	913.4	959.5	992.2	1043.8	1147.4
33	914.8	953.0	999.1	1032.1	1084.2	1189.3
34	954.8	993.0	1039.4	1072.5	1125.0	1231.6
35	995.7	1033.9	1080.1	1113.3	1166.2	1274.2
36	1037.5	1075.4	1121.6	1154.8	1207.9	1317.2
37	1080.2	1118.0	1163.8	1197.0	1250.2	1360.6
38	1124.4	1161.5	1207.0	1240.0	1293.3	1404.7
39	1169.6	1206.3	1251.2	1284.0	1337.1	1449.4
40	1216.6	1252.6	1296.7	1329.1	1382.1	1494.9

Table 15
Service facility use—finite source with no queuing (ENGSET) (in CCS); number in source = 50 (Part 1 of 2)

	Grade of service (GOS)—traffic offered					
Number	**0.005**	**0.010**	**0.020**	**0.030**	**0.050**	**0.100**
1	0.2	0.4	0.7	1.1	1.9	4.1
2	3.9	5.6	8.3	10.4	14.1	21.9
3	13.0	17.0	22.4	26.6	33.3	46.9
4	26.3	32.6	40.8	46.9	56.6	75.6
5	42.7	51.2	62.1	70.1	82.6	106.6
6	61.5	72.1	85.6	95.3	110.5	139.1
7	82.2	94.9	110.7	122.1	139.7	172.9
8	104.5	119.0	137.2	150.2	170.1	207.6
9	128.0	144.5	164.8	179.2	201.4	243.0
10	152.7	170.9	193.3	209.2	233.4	278.9
11	178.4	198.3	222.6	239.8	266.1	315.4
12	205.0	226.5	252.7	271.1	299.3	352.3
13	232.3	255.3	283.3	303.0	333.1	389.5
14	260.5	284.9	314.5	335.4	367.3	427.1
15	289.3	315.0	346.3	368.3	401.8	464.9
16	318.6	345.7	378.5	401.6	436.7	503.0
17	348.6	376.9	411.2	435.2	472.0	541.4
18	379.1	408.7	444.2	469.3	507.5	580.0
19	410.2	440.8	477.7	503.7	543.4	618.7
20	441.7	473.4	511.6	538.4	579.5	657.7

Table 15
Service facility use—finite source with no queuing (ENGSET) (in CCS); number in source = 50 (Part 2 of 2)

	Grade of service (GOS)—traffic offered					
Number	**0.005**	**0.010**	**0.020**	**0.030**	**0.050**	**0.100**
21	473.8	506.5	545.8	573.5	615.9	696.8
22	506.3	539.9	580.4	608.8	652.5	736.2
23	539.3	573.7	615.2	644.5	689.3	775.7
24	572.7	608.0	650.4	680.4	726.5	815.3
25	606.4	642.5	686.0	716.6	763.8	855.1
26	640.8	677.5	721.9	753.1	801.3	895.0
27	675.4	712.9	758.0	789.8	839.1	935.1
28	710.6	748.6	794.5	826.9	877.1	975.4
29	746.2	784.8	831.3	864.2	915.3	1015.8
30	782.1	821.2	868.4	901.8	953.8	1056.4
31	818.6	858.1	905.8	939.6	992.4	1097.1
32	855.6	895.5	943.6	977.8	1031.4	1138.0
33	892.9	933.1	981.7	1016.3	1070.6	1179.1
34	930.8	971.3	1020.2	1055.1	1110.0	1220.3
35	969.3	1009.9	1059.0	1094.2	1149.7	1261.8
36	1008.3	1049.0	1098.3	1133.7	1189.8	1303.5
37	1047.7	1088.5	1138.0	1173.6	1230.1	1345.4
38	1088.0	1128.7	1178.2	1213.9	1270.8	1387.0
39	1128.9	1169.5	1218.9	1254.6	1311.9	1430.0
40	1170.5	1210.8	1260.2	1295.9	1353.4	1472.9

Table 16
Service facility use—finite source with queuing (ENGSET) (in CCS); number in source = 5

	Delay/holding time (D/HT)—traffic offered					
Number	**0.25**	**0.50**	**0.75**	**1.00**	**2.00**	**4.00**
1	9.5	16.5	21.8	25.9	34.0	36.0
2	48.6	62.4	68.7	71.2	72.0	72.0
3	97.9	107.4	108.0	108.0	108.0	108.8
4	143.8	144.0	144.0	144.0	144.0	144.0

Table 17
Service facility use—finite source with queuing (ENGSET) (in CCS); number in source = 10

	Delay/holding time (D/HT)—traffic offered					
Number	**0.25**	**0.50**	**0.75**	**1.00**	**2.00**	**4.00**
1	8.2	14.0	18.8	21.6	29.9	35.2
2	39.4	51.9	59.3	64.1	71.2	71.9
3	78.8	94.5	102.0	105.6	108.0	108.0
4	121.6	137.2	142.4	143.8	144.0	144.0
5	165.4	177.9	179.9	179.9	180.0	180.0
6	208.6	215.8	216.0	216.0	216.0	216.0
7	250.0	252.0	252.0	252.0	252.0	252.0
8	287.9	288.0	288.0	288.0	288.0	288.0
9	324.0	324.0	324.0	324.0	324.0	324.0

Table 18
Service facility use—finite source with queuing (ENGSET) (in CCS); number in source = 15

	Delay/holding time (D/HT)—traffic offered					
Number	**0.25**	**0.50**	**0.75**	**1.00**	**2.00**	**4.00**
1	7.8	13.3	17.8	20.4	28.1	34.0
2	36.8	48.4	55.5	60.3	69.3	72.0
3	72.9	88.3	96.7	101.6	107.7	108.0
4	112.3	129.6	137.6	141.4	144.0	144.0
5	153.2	170.7	177.2	179.4	180.0	180.0
6	194.9	210.9	215.2	216.0	216.0	216.0
7	236.6	249.8	251.9	252.0	252.0	252.0
8	277.9	287.4	288.0	288.0	288.0	288.0
9	318.3	324.0	324.0	324.0	324.0	324.0
10	357.7	359.8	360.0	360.0	360.0	360.0
11	395.6	396.0	396.0	396.0	396.0	396.0

Table 19
Service facility use—finite source with queuing (ENGSET) (in CCS); number in source = 20

	Delay/holding time (D/HT)—traffic offered					
Number	**0.25**	**0.50**	**0.75**	**1.00**	**2.00**	**4.00**
1	7.7	12.9	16.8	19.8	27.2	38.1
2	35.6	46.7	53.5	58.3	67.7	71.8
3	70.1	85.0	93.4	98.7	106.8	108.0
4	107.6	125.0	133.9	138.7	143.9	144.0
5	146.8	165.5	173.7	177.6	180.0	180.0
6	186.9	205.7	212.7	215.2	216.0	216.0
7	227.5	245.3	250.6	251.8	252.0	252.0
8	268.1	284.1	287.6	288.0	288.0	288.0
9	308.7	322.1	323.9	324.0	324.0	324.0
10	348.9	359.3	360.0	360.0	360.0	360.0
11	388.5	395.8	396.0	396.0	396.0	396.0
12	427.6	432.0	432.0	432.0	432.0	432.0
13	465.9	468.0	468.0	468.0	468.0	468.0
14	503.3	504.0	504.0	504.0	504.0	504.0
15	539.9	540.0	540.0	540.0	540.0	540.0

Table 20
Service facility use—finite source with queuing (ENGSET) (in CCS); number in source = 25

	Delay/holding time (D/HT)—traffic offered					
Number	**0.25**	**0.50**	**0.75**	**1.00**	**2.00**	**4.00**
1	7.6	12.8	16.5	19.5	26.6	32.5
2	34.9	45.7	52.3	57.0	66.5	71.5
3	68.4	83.0	91.3	96.7	105.8	108.0
4	104.8	122.1	131.1	136.5	143.4	144.0
5	142.8	161.8	170.9	175.6	179.9	180.0
6	181.8	201.6	210.1	213.8	216.0	216.0
7	221.5	241.2	248.5	251.1	252.0	252.0
8	261.4	280.4	286.2	287.7	288.0	288.0
9	301.4	319.0	323.3	324.0	324.0	324.0
10	341.4	357.0	359.8	360.0	360.0	360.0
11	381.1	394.4	396.0	396.0	396.0	396.0
12	420.6	431.3	432.0	432.0	432.0	432.0
13	459.7	467.8	468.0	468.0	468.0	468.0
14	498.3	504.0	504.0	504.0	504.0	504.0
15	536.5	540.0	540.0	540.0	540.0	540.0
16	574.1	576.0	576.0	576.0	576.0	576.0
17	611.2	612.0	612.0	612.0	612.0	612.0
18	647.8	648.0	648.0	648.0	648.0	648.0

Table 21
Service facility use—finite source with queuing (ENGSET) (in CCS); number in source = 30 (Part 1 of 2)

	Delay/holding time (D/HT)—traffic offered					
Number	**0.25**	**0.50**	**0.75**	**1.00**	**2.00**	**4.00**
1	7.5	12.6	16.3	19.2	26.2	32.0
2	34.4	45.0	51.5	56.0	65.6	71.1
3	67.3	81.6	89.8	95.2	104.9	107.9
4	102.9	120.0	129.1	134.7	142.9	144.0
5	140.1	159.1	168.6	173.8	179.7	180.0
6	178.4	198.5	207.8	212.3	216.0	216.0
7	217.2	237.9	246.4	250.0	252.0	252.0
8	256.5	277.1	284.5	287.1	288.0	288.0
9	296.0	315.9	322.0	323.7	324.0	324.0
10	335.6	354.3	359.0	359.9	360.0	360.0
11	375.1	392.2	395.6	396.0	396.0	396.0
12	414.5	429.6	431.9	432.0	432.0	432.0

Table 21
Service facility use—finite source with queuing (ENGSET) (in CCS); number in source = 30 (Part 2 of 2)

	Delay/holding time (D/HT)—traffic offered					
Number	**0.25**	**0.50**	**0.75**	**1.00**	**2.00**	**4.00**
13	453.7	466.7	468.0	468.0	468.0	468.0
14	492.6	503.4	504.0	504.0	504.0	504.0
15	531.3	539.8	540.0	540.0	540.0	540.0
16	569.6	575.9	576.0	576.0	576.0	576.0
17	607.6	612.0	612.0	612.0	612.0	612.0
18	645.2	648.0	648.0	648.0	648.0	648.0
19	682.4	684.0	684.0	684.0	684.0	684.0
20	719.2	720.0	720.0	720.0	720.0	720.0
21	755.7	756.0	756.0	756.0	756.0	756.0
22	791.9	792.0	792.0	792.0	792.0	792.0

Table 22
Service facility use—finite source with queuing (ENGSET) (in CCS); number in source = 35 (Part 1 of 2)

	Delay/holding time (D/HT)—traffic offered					
Number	**0.25**	**0.50**	**0.75**	**1.00**	**2.00**	**4.00**
1	7.5	12.5	16.2	19.0	25.9	31.7
2	34.1	44.5	50.9	55.4	64.9	70.7
3	66.5	80.6	88.7	94.1	104.1	107.8
4	101.6	118.4	127.6	133.3	142.3	144.0
5	138.2	157.1	166.7	172.3	179.4	180.0
6	175.8	196.1	205.8	210.9	215.9	216.0
7	214.1	235.3	244.5	248.9	252.0	252.0
8	252.9	274.3	282.8	286.3	288.0	288.0
9	291.9	313.1	320.6	323.2	324.0	324.0
10	331.0	351.6	358.0	359.7	360.0	360.0
11	370.3	389.8	394.9	395.9	396.0	396.0
12	409.5	427.5	431.5	432.0	432.0	432.0
13	448.6	465.1	467.8	468.0	468.0	468.0
14	487.5	502.2	503.9	504.0	504.0	504.0
15	526.3	538.9	540.0	540.0	540.0	540.0

Table 22
Service facility use—finite source with queuing (ENGSET) (in CCS); number in source = 35 (Part 2 of 2)

	Delay/holding time (D/HT)—traffic offered					
Number	**0.25**	**0.50**	**0.75**	**1.00**	**2.00**	**4.00**
16	564.9	575.5	576.0	576.0	576.0	576.0
17	603.2	611.8	612.0	612.0	612.0	612.0
18	641.3	647.9	648.0	648.0	648.0	648.0
19	679.1	684.0	684.0	684.0	684.0	684.0
20	716.6	720.0	720.0	720.0	720.0	720.0
21	753.8	756.0	756.0	756.0	756.0	756.0
22	790.7	792.0	792.0	792.0	792.0	792.0
23	827.3	828.0	828.0	828.0	828.0	828.0
24	863.7	864.0	864.0	864.0	864.0	864.0
25	899.9	900.0	900.0	900.0	900.0	900.0

Table 23
Service facility use—finite source with queuing (ENGSET) (in CCS); number in source = 40 (Part 1 of 2)

	Delay/holding time (D/HT)—traffic offered					
Number	**0.25**	**0.50**	**0.75**	**1.00**	**2.00**	**4.00**
1	7.4	12.5	16.1	18.9	25.7	31.4
2	33.8	44.1	50.5	54.9	64.3	70.4
3	65.9	79.8	87.8	93.2	103.3	107.7
4	100.6	117.2	126.3	132.1	141.7	144.0
5	136.7	155.5	165.2	171.0	179.1	180.0
6	173.9	194.2	204.2	209.6	215.7	216.0
7	211.7	233.1	242.9	247.7	251.9	252.0
8	250.0	272.0	281.2	285.4	288.0	288.0
9	288.6	310.7	319.2	322.5	324.0	324.0
10	327.4	349.3	356.8	359.2	360.0	360.0
11	366.4	387.5	394.0	395.7	396.0	396.0
12	405.3	425.5	430.8	431.9	432.0	432.0
13	444.2	463.4	467.4	468.0	468.0	468.0
14	483.1	500.6	503.7	504.0	504.0	504.0
15	521.9	537.7	539.9	540.0	540.0	540.0
16	560.5	574.5	576.0	576.0	576.0	576.0
17	599.0	611.1	612.0	612.0	612.0	612.0
18	637.2	647.5	648.0	648.0	648.0	648.0

Table 23
Service facility use—finite source with queuing (ENGSET) (in CCS); number in source = 40 (Part 2 of 2)

	Delay/holding time (D/HT)—traffic offered					
Number	**0.25**	**0.50**	**0.75**	**1.00**	**2.00**	**4.00**
19	675.3	683.8	684.0	684.0	684.0	684.0
20	713.1	719.9	720.0	720.0	720.0	720.0
21	750.7	756.0	756.0	756.0	756.0	765.0
22	788.1	792.0	792.0	792.0	792.0	792.0
23	825.3	828.0	828.0	828.0	828.0	828.0
24	362.2	864.0	864.0	864.0	864.0	864.0
25	898.9	900.0	900.0	900.0	900.0	900.0
26	935.4	936.0	936.0	936.0	936.0	936.0
27	971.7	972.0	972.0	972.0	972.0	972.0
28	1007.9	1008.0	1008.0	1008.0	1008.0	1008.0

Table 24
Service facility use—finite source with queuing (ENGSET) (in CCS); number in source = 45 (Part 1 of 2)

	Delay/holding time (D/HT)—traffic offered					
Number	**0.25**	**0.50**	**0.75**	**1.00**	**2.00**	**4.00**
1	7.4	12.4	16.0	18.8	25.5	31.2
2	33.7	43.8	50.1	54.5	63.8	70.1
3	65.5	79.2	87.1	92.4	102.7	107.6
4	99.8	116.3	125.3	131.1	141.1	144.0
5	135.6	154.2	164.0	169.9	178.6	180.0
6	172.3	192.6	202.7	208.5	215.5	216.0
7	209.8	231.3	241.4	246.7	251.9	252.0
8	247.7	270.0	279.8	284.4	288.0	288.0
9	286.0	308.6	317.8	321.8	324.0	324.0
10	324.5	347.1	355.6	358.7	360.0	360.0
11	363.1	385.5	393.0	395.3	396.0	396.0
12	401.9	423.6	430.0	431.7	432.0	432.0
13	440.6	461.4	466.8	467.9	468.0	468.0
14	479.3	499.0	503.3	504.0	504.0	504.0
15	518.0	536.3	539.6	540.0	540.0	540.0
16	556.6	573.4	575.8	576.0	576.0	576.0
17	595.1	610.2	611.9	612.0	612.0	612.0
18	633.4	646.9	648.0	648.0	648.0	648.0
19	671.6	683.3	684.0	684.0	684.0	684.0
20	709.6	719.6	720.0	720.0	720.0	720.0

Table 24
Service facility use—finite source with queuing (ENGSET) (in CCS); number in source = 45 (Part 2 of 2)

	Delay/holding time (D/HT)—traffic offered					
Number	**0.25**	**0.50**	**0.75**	**1.00**	**2.00**	**4.00**
21	747.4	755.8	756.0	756.0	756.0	756.0
22	785.1	791.9	792.0	792.0	792.0	792.0
23	822.6	828.0	828.0	828.0	828.0	828.0
24	859.8	864.0	864.0	864.0	864.0	864.0
25	896.9	900.0	900.0	900.0	900.0	900.0
26	933.8	936.0	936.0	936.0	936.0	936.0
27	970.5	972.0	972.0	972.0	972.0	972.0
28	1007.1	1008.0	1008.0	1008.0	1008.0	1008.0
29	1043.5	1044.0	1044.0	1044.0	1044.0	1044.0
30	1079.7	1080.0	1080.0	1080.0	1080.0	1080.0

Table 25
Service facility use—finite source with queuing (ENGSET) (in CCS); number in source = 50 (Part 1 of 2)

	Delay/holding time (D/HT)—traffic offered					
Number	**0.25**	**0.50**	**0.75**	**1.00**	**2.00**	**4.00**
1	7.4	12.4	16.0	18.7	25.3	31.0
2	33.5	43.6	49.8	54.1	63.4	69.8
3	65.1	78.7	86.6	91.8	102.2	107.4
4	99.1	115.5	124.5	130.3	140.6	143.9
5	134.6	153.1	163.0	168.9	178.2	180.0
6	171.1	191.3	201.5	207.5	215.2	216.0
7	208.2	229.7	240.1	245.7	251.7	252.0
8	245.8	268.3	278.4	283.5	287.9	288.0
9	283.8	306.8	316.6	321.0	324.0	324.0
10	322.1	345.3	354.4	358.1	360.0	360.0
11	360.4	383.6	391.9	394.9	396.0	396.0
12	399.0	421.7	429.1	431.4	432.0	432.0
13	437.5	459.6	466.1	467.7	468.0	468.0
14	476.1	497.3	502.8	503.9	504.0	504.0
15	514.6	534.8	539.3	540.0	540.0	540.0
16	553.1	572.1	575.6	576.0	576.0	576.0
17	591.6	609.1	611.8	612.0	612.0	612.0
18	629.9	645.9	647.9	648.0	648.0	648.0
19	668.1	682.6	684.0	684.0	684.0	684.0
20	706.2	719.1	720.0	720.0	720.0	720.0

Table 25
Service facility use—finite source with queuing (ENGSET) (in CCS); number in source = 50 (Part 2 of 2)

	Delay/holding time (D/HT)—traffic offered					
Number	**0.25**	**0.50**	**0.75**	**1.00**	**2.00**	**4.00**
21	744.2	755.4	756.0	756.0	756.0	756.0
22	782.0	791.7	792.0	792.0	792.0	792.0
23	819.7	827.8	828.0	828.0	828.0	828.0
24	857.2	863.9	864.0	864.0	864.0	864.0
25	894.5	900.0	900.0	900.0	900.0	900.0
26	931.7	936.0	936.0	936.0	936.0	936.0
27	968.7	972.0	972.0	972.0	972.0	972.0
28	1005.6	1008.0	1008.0	1008.0	1008.0	1008.0
29	1042.3	1044.0	1044.0	1044.0	1044.0	1044.0
30	1078.8	1080.0	1080.0	1080.0	1080.0	1080.0
31	1115.2	1116.0	1116.0	1116.0	1116.0	1116.0
32	1151.6	1152.0	1152.0	1152.0	1152.0	1152.0
33	1187.8	1188.0	1188.0	1188.0	1188.0	1188.0
34	1223.9	1224.0	1224.0	1224.0	1224.0	1224.0

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Meridian 1

Meridian data features

Traffic engineering and configuration

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Publication number: 553-2731-151
Document release: Standard 6.00
Date: April 2000
Printed in Canada

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